AERONAUTICAL ENGINEERING REVIEW

INSTITUTE OF THE AERONAUTICAL SCIENCES
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MOR

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Cover—American and British Delegates join in ceremonies at Guildhall, London

Editor
Welman A. Shrader

Technical Advisers
Hugh L. Dryden — Robert R. Dexter
S. Paul Johnston

Associate Editor
B. H. Jarck

Reviews Editor
John J. Glennon

News Editor
Randolph Hawthorne

Book Reviews
Edward G. Ingram

Acting Manager
Joseph P. Ryan

Manager, Western Region
James L. Straight
6715 Hollywood Blvd., Los Angeles 28, Calif.

SUBSCRIPTION RATES

Aeronautical Engineering Review: United States and possessions, 1 year, $3.00; single copies $0.30. Foreign countries including Canada (American Currency Rates), 1 year, $3.50; single copies, $0.35.

Entered as second-class matter at the Post Office, Easton, Pa., April 29, 1942. Acceptance for mailing at a Special Rate of Postage as provided for in the Act of August 24, 1912.

Publication Office: 20th & Northampton Streets, Easton, Pa.

Editorial Office: 2 East 64th Street, New York 21, N.Y

Notices of change of address should be sent to the Institute at least 30 days prior to actual change of address.

Statements and opinions expressed in the *Aeronautical Engineering Review* are to be understood as individual expressions and not those of the Institute.

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AERONAUTICAL ENGINEERING REVIEW

Vol. 6 — October, 1947 — No. 10

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Published Monthly by the Institute of the Aeronautical Sciences, Inc.

A CRYSTAL THAT GREW FROM A SEED . . . *The large crystal in the foreground is an EDT (Ethylene Diamine Tartrate) crystal. It started from a seed (a piece of mother crystal) and in three months grew in a slowly cooling solution to the size shown. The small plate is cut from a large crystal, then gold-plated for electrical connection and mounted in vacuum. Cultivated EDT crystals can do the same job as quartz in separating the nearly 500 conversations carried by a coaxial circuit.*

Crystals for Conversations

AT WAR'S END, the Bell System began to build many more Long Distance coaxial circuits. Hundreds of telephone calls can be carried by each of these because of electric wave filters, which guide each conversation along its assigned frequency channel. Key to these filters was their frequency-sensitive plates of quartz.

But there was not enough suitable quartz available to build all the filters needed. Bell Telephone Laboratories scientists met the emergency with cultivated crystals. Years of research enabled them to write the prescription at once—a crystal which is grown in a laboratory, and which replaces quartz in these channel filters.

Now Western Electric, manufacturing unit of the Bell System, is growing crystals by the thousands. Many more Long Distance telephone circuits, in urgent demand, can be built, because the scientists of Bell Telephone Laboratories had studied the physics and chemistry of artificial crystals.

BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

I.A.S. News

A Record of People and Events of Interest to Institute Members

High British Honor Accorded American Delegates in London

Dinner at Historic Guildhall, Scene of Much Ceremony in the Past, Is Special Event; Lord Mayor, the Sheriffs, Ambassador Douglas Present.

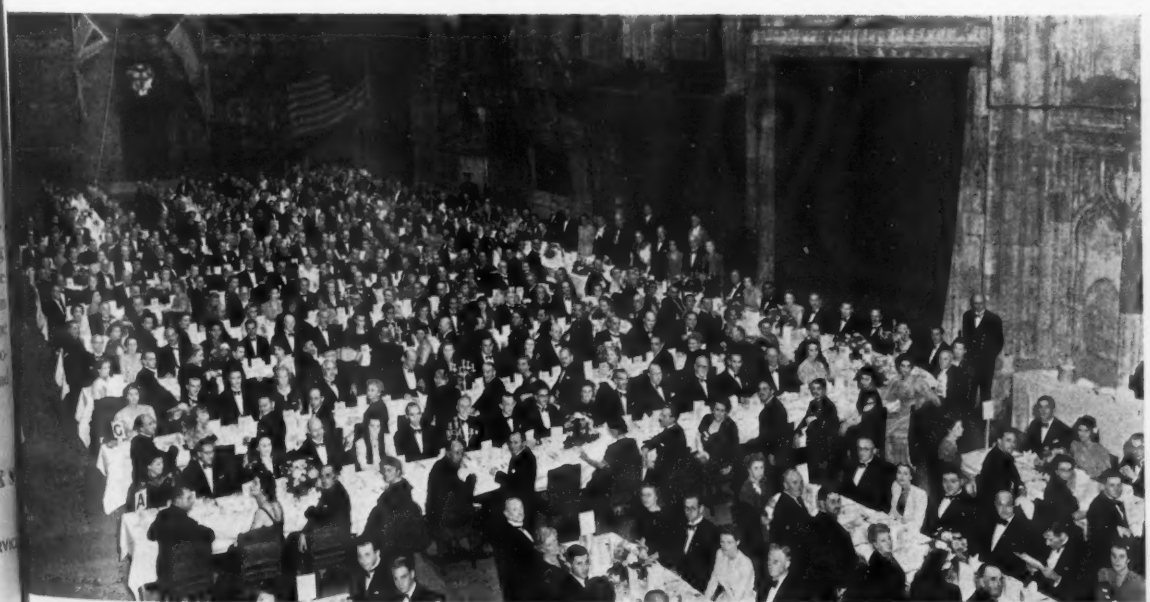
One of the greatest honors the British could bestow was given the American Delegates to the joint conference of the Royal Aeronautical Society and Institute of the Aeronautical Sciences who were invited to the special Dinner at Guildhall September 9. Attending were the Lord Mayor of London, the Right Honorable Sir Bracewell Smith; the Lady Mayoress, Lady Bracewell Smith; the American Ambassador, Mr. Lewis Douglas, and Mrs. Lewis Douglas, Sheriffs and members of the British government and aircraft industry.

▶ **Great Historical Building**—Guildhall is early fourteenth century. There for the past 500 years, the Kings and Queens of England, royalty from many lands, and heads of great states have been entertained. Much of it was destroyed in the Great Fire of 1666, and again in 1940 it was burnt out during a raid by 400 German bombers.

At one end of the Guildhall, which still bears the scars of war, were displayed the Union Jack and the Stars and Stripes, and banners of the City of London and the Royal Aeronautical Society. Toasts to "The King" and to "The President of the United States of America" were honored by the assembly, and the national anthems of both countries were played by the orchestra of the Central Band of the Royal Air Force. Grace and Thanksgiving were rendered before and after dinner by members of St. Paul's Cathedral Choir, and a fanfare by trumpeters of the R.A.F. heralded each of the speakers.

Toward the end of the dinner the Loving Cup was passed around by the Council of the Royal Aeronautical Society. The Loving Cup is an age-old ceremony of mutual friendship originating from the Scottish clans.

British honor American Delegates at dinner in historic Guildhall, London.



▶ **"Culminating Dinner"**—Sir Frederick Handley Page, President of the R.Ae.S., remarking that it appealed to him that "we of this country and our brothers across the seas had a common heritage," said that it was a great thing, both fitting and appropriate, that they should enjoy the culminating dinner in order that they might celebrate in fullness of heart what they really felt.

In the conference which had ended so happily, he continued, they had worked together on common lines and had cemented a friendship which was to endure for all time.

▶ **Thanks British Colleagues**—Preston R. Bassett, President of the Institute, said in reply that he felt the joint conference had been even more successful than anticipated. He hoped that it would be repeated and that many of their colleagues from Britain would go to the United States to attend the next joint meeting. He expressed the thanks of all who had come from America to attend the conference in London.

Dryden Succeeds Lewis in N.A.C.A. Post

One Past-President and Honorary Fellow of the Institute succeeded another in appointments announced by the National Advisory Committee for Aeronautics in late August.

Dr. Hugh L. Dryden, formerly Associate Director of the National Bureau of Standards, was named Director of Aeronautical Research, succeeding Dr. George W. Lewis, internationally known scientist, who has been appointed Research Consultant to the N.A.C.A. New appointments took effect September 1.

▶ **Parallel Careers**—Each of the two N.A.C.A. scientists has developed along somewhat parallel lines in the aeronautic sciences. Both have been concerned in wind-tunnel research, both have received high awards in recognition of their services in aeronautical research and development, and both have served the Government in official capacities in aeronautical matters, in addition to being Past-Presidents—Lewis in 1939, Dryden in 1943—and Honorary Fellows of I.A.S.

In 1938 Dr. Dryden gave the annual Wright Brothers Lecture and in 1940 was the recipient of The Sylvanus Albert Reed Award for his contributions to the aeronautical sciences. His work has been principally concerned with wind pressure on structures, turbulence in wind tunnels, properties of airfoils at high speeds, and boundary-layer investigations.

In New Post: *Dr. Hugh L. Dryden is new Director of Aeronautical Research, National Advisory Committee of Aeronautics, succeeding Dr. George W. Lewis, who was appointed Research Consultant to N.A.C.A.*

He also developed the hot-wire anemometer into an instrument for accurately determining fluctuations on the airflow in the boundary layer and the meaning of the disturbances of the flow.

Dr. Dryden had been with the National Bureau of Standards since 1918 as Physicist, Chief of the Aerodynamics Section, Chief of Mechanics and Sound Division, Assistant Director, and Associate Director.

▶ **War Duties**—During World War II, Dryden was Vice-Chairman of Committee on Aerodynamics of N.A.C.A.; Chairman of N.A.C.A. Committee on Self-Propelled Guided Missiles; and Chief of Division of New Missiles of the National Defense Research Committee. He guided development of the radar homing missile, Bat, used by the Navy against Japanese shipping, receiving the Presidential Certificate of Merit for his work.

In addition, he served on numerous committees dealing with guided missiles under sponsorship of the Joint Chiefs of Staff, N.A.C.A., Army Ordnance Department, and Army Air Forces; was a member of A.A.F. Scientific Advisory Group appointed by General Arnold; and in 1945 accompanied other members of the group to Europe to study foreign developments in the application of science to problems of aerial warfare, especially in the field of guided missiles. For this work he was awarded the Medal of Freedom.

At present he is Chairman of the Guided Missiles and Pilotless Aircraft Panel of the Scientific Advisory Board to the Commanding General, Army Air Forces, and a member of the Guided Missiles Committee of the Joint Research and Development Board.

I.A.S. Calendar

December 17, 1947	Wright Brothers Lecture,	Washington, D.C.
January 26–29, 1948	Sixteenth Annual Meeting,	New York

For details see page 69

Gifts to the Institute Collections

Mr. and Mrs. Gordon Wightman added to their previous generous gifts in memory of their son, Henry Nicoll Wightman, a specially made model of the duPont Utility Glider, which he flew to a record of 135 miles in 1936, from Elmira to Middletown, N.Y. Paul Guillow, of Wakefield, Mass., added a model of the airplane constructed by Sir Hiram Maxim in 1893 to the outstanding collection of historical models he gave in 1945. Howard Zeimer added aviation buttons to his previous gifts. Two of its insignia pins were received from Aer Lingus, Dublin.

The French Embassy gave twelve recent French books and issues of eight French periodicals. The Aeronautical Digest Publishing Corporation gave 100 issues of foreign aeronautical periodicals through the courtesy of Nathaniel F. Silsbee. Six cartons of N.A.C.A. *Wartime Reports* were received from the Eclipse-Pioneer Division of the Bendix Aviation Corporation through the courtesy of Miss Mildred M. Baker. Prof. R. Giacomelli, of Rome, sent his book *Atom Bomb and Mass Destruction*. Walter H. Wager gave a typed copy of his thesis, "American Policy in the Negotiation of International Landing Rights." Operation manuals of the DC-3, DC-4, and DC-6 airplanes, its *Drafting Room Manual*, and several of its reports were sent by the Douglas Aircraft Company, Inc. Esso, Inc., gave three copies of the *Esso Co-Pilot*. A report on supersonic control surfaces was received from Prof. Paco Lagerstrom.

Additions to their previous gifts were received from the Australian Council for Aeronautics, the Dow Corning Corporation, Arthur Halstead, the Society of Automotive Engineers, Air Documents Division of the Air Matériel Command, David Taylor Model Basin, and the U.S. Bureau of Ships.

Admiral Richardson Named V.-P., Curtiss-Wright Corp.

Rear Adm. Lawrence B. Richardson, U.S.N. (Ret.), has been elected Vice-President of Curtiss-Wright Corporation, it was announced by Guy W. Vaughan, President. The admiral, who has an exceptionally broad experience in the design, development, manufacture, and inspection of aircraft and who made an outstanding record in Navy's BuAer, is a member of the Institute's Advisory Committee.

▸ **Joined C.-W. Year Ago**—Retiring after 29 years of active naval service, Richardson joined Curtiss-Wright as Executive Assistant to the President 1 year ago September 1.

Widely known to executives throughout the aircraft industry, he is a member of the National Advisory Committee for Aeronautics and during the war served as sole Navy representative on the Aircraft Production Board of the W.P.B., in addition to other duties.

▸ **Pilot Since 1925**—Following service as Naval Inspection representative at various aircraft manufacturing plants after World War I, Richardson received flight training at Pensacola, qualifying in 1925 as pilot of all types of naval aircraft. He still holds the designation of Naval Aviator.

The next 10 years he served in various engineering, administrative, and industrial capacities in naval aviation, was 3 years at the Philadelphia Naval Aircraft Factory, and was with BuAer since 1941 until the time of his retirement. He was promoted to the rank of Rear Admiral in 1943 when he became Assistant Chief, Bureau of Aeronautics.

I.A.S. Constitution Amendments Approved at Council Meeting

Four amendments to, and seven deletions from, the Constitution of the Institute of the Aeronautical Sciences were approved by the voting members and reported at a meeting of the Council held in Los Angeles on August 6, 1947.

Stating that, at the last meeting of the Council, a resolution was adopted authorizing the Secretary to submit proposed amendments to the Constitution to the voting members, Preston R. Bassett, President, asked Elmer A. Sperry, Jr., to submit the tellers' report.

▸ **Amendments Approved** — Mr. Sperry stated that the following amendments were approved:

• **Article 4—Section 6:** Directors and Officers—The officers of the Institute shall be the President, four Vice-Presidents, the Secretary, the Treasurer, and such other officers as shall be provided by the By-Laws. The officers of the Institute shall be elected by the Council at a meeting held at least 1 week prior to the Annual Meeting of the Institute.

• **Article 6—Section 5:** Government—Should a vacancy occur in the Council or in any elective office except the Presidency, the Council may appoint a voting member of the Institute to fill the vacancy until the next Annual Meeting. Should a vacancy occur in the Presidency, the Council shall elect one of the four Vice-Presidents to fill the vacancy until the next annual election. Such appointment or election shall not render an officer ineligible for immediate election to the same office.

• **Article 6—New Section**—In the absence of the President, a Vice-President, or in the absence of all the Vice-Presidents, a member of the Council, chosen by it, may preside at meetings of the Institute.

• **Article 9—Section 1:** Committees—There shall be the following permanent committees: Advisory; Buildings; Editorial; Executive; Finance; Meetings; Membership; Nominating Committee for Area Councilors; Nominating; Pension; Professional Activities; Section; and such other permanent and special committees as may be specified in the By-Laws or by resolution of the Council. The duties of all committees shall be as defined in the By-Laws.

▸ **Deletions**—The following Section deletions also were approved:

• **Section 4**—The Administrative Committee of the Institute shall consist of staff officers of the Institute as defined in the By-Laws.

• **Section 5**—An Advisory Committee consisting of at least 20 voting members of the Institute shall be appointed by the President with the approval of the Council.

• **Section 6**—The Buildings Committee shall consist of at least five members.

• **Section 7**—The Editorial Committee and the Professional Activities Committee shall consist of aeronautical engineers and other specialists.

• **Section 10**—The Meetings Committee shall consist of not less than six members.

• **Section 11**—The Membership Committee shall consist of not less than ten voting members.

• **Section 15**—The Sections Committee shall consist of the Chairman of all Sections of the Institute.

I.A.S. Newslines

▸ **Wellwood E. Beall,** a Vice-President and Fellow of the Institute, speaking at opening session of 3-day symposium on high-altitude flight sponsored by Boeing in Seattle, August 25–27, declared that fast, safe, economical flight is possible at altitudes up to $5\frac{1}{2}$ miles.

▸ **Guy Lee Bryan, Jr.,** formerly Chief Designer and lately Chief of Technical Dept., The Glenn L. Martin Company, has been appointed Associate Professor of Aeronautics at The Johns Hopkins University. He is an Associate Fellow of I.A.S.

▸ **W. A. M. Burden,** former Assistant Secretary of Commerce for Air, was elected a member of the Board of Governors of the National Air Council, successor to the Air Power League. Burden is an Honorary Member and I.A.S. Council member.

▸ **Samuel K. Hoffman,** Associate Fellow, is Professor of Aeronautical Engineering, The Pennsylvania State College.

▸ **General George C. Kenny,** Commanding General, U.S. Air Force Strategic Air Command, an Honorary Member of the Institute, recommends radar-equipped B-36 search missions as best aerial defense. Long-range patrol planes, operating several hundred miles beyond borders of U.S. as an aerial Coast Guard, should be promptly established, in general's opinion.

▸ **Grover C. Loening,** Fellow and member of I.A.S. Council, was appointed Research and Development Specialist on President Truman's Air Policy Commission. Loening also is a member of the Advisory Board of new National Air Museum.

▸ **Theodore C. Lonnquest,** an Honorary Member of I.A.S. who participated in Operation Crossroads at Bikini, has been promoted to Rear Admiral, U.S.N., and is Assistant Chief, Bureau of Aeronautics for Research and Development.

▸ **Alfred Marchev,** an Associate Fellow of the Institute and former President and Chairman of the Board of Republic Aviation Corporation, was named President and General Manager of Aircraft Screw Products Company, Inc., Long Island City, N.Y.

▸ **Edwin G. Markle,** Associate Fellow of the Institute, resigned from Douglas Aircraft and is now Structural Engineering Assistant, City of Los

Silicone News

DC SILICONES

DC Silicone Insulation saves space and weight in aircraft industry

PHOTO COURTESY WELLS AIRCRAFT PARTS CO.

When big transport planes land at 90 mph, the friction required to get the wheels turning at landing speed wears out the tires rapidly and puts a great strain on the landing struts. That's why so much time and money have been spent on various devices for pre-rotating aircraft wheels.

Most recent and promising is a Silicone insulated ring-type motor designed by Otto E. Dever of Los Angeles and built by Wells Aircraft Parts Co., also of Los Angeles, for flight testing on the Lockheed "Constitution."

The Dever Pre-rotation Motor weighs less than 14 pounds and is designed as an integral part of the wheel. The motors built for the Constitution deliver 9 hp in accelerating the wheels to a landing speed of 630 r.p.m. in two minutes. Since that speed must be maintained within 5% for just a few minutes, these motors work hard but briefly.

Probably Class "B" insulation would withstand such severe but intermittent service for a limited time. There would be little economy, however, in having to rewind the motors after a few landings. By specifying DC Silicone Insulation, Mr. Dever recognizes the difference between war and peacetime economies.

During the war, aircraft motors and generators were built to save space and weight at the expense of service life. That was good wartime economy but it is not sound commercial practice.

The introduction of Dow Corning Silicone Insulation makes it possible to reduce the size and weight of electric machines by about 50% and still secure long and reliable service, even under conditions of extreme humidity. More information about DC Silicone Insulation is given in leaflet No. S-5A

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In England: Albright and Wilson, Ltd., London

Dow Corning
FIRST IN SILICONES

Angeles, Bureau of Engineering, Department of Public Works.

▸ **Major Gen. E. M. Powers,** Air Force Assistant Chief of Staff for Materiel and Supply, an Honorary Member of the Institute, was named to National Air Museum's Advisory Board.

▸ **Addison M. Rothrock,** a Fellow of I.A.S., is now Assistant Director of Aeronautical Research, N.A.C.A.

▸ **D. Roy Shoults,** Associate Fellow of I.A.S., was appointed Chief Engineer, The Glenn L. Martin Company, reporting to W. K. Ebel, Vice-President—Engineering.

▸ **William B. Stout,** veteran aircraft designer now with Consolidated Vultee Aircraft Corporation as Consultant, and a Fellow of the Institute, is a member of the Advisory Board of the National Air Museum.

▸ **Philip B. Taylor,** formerly President of Taylor Turbine Corporation, is a partner of Sanderson & Porter, New York. He is a Fellow of I.A.S.

▸ **T. P. Wright,** Honorary Fellow and Past-President (1938) of I.A.S., told joint Institute and Royal Aeronautical Society meeting in London that he could see no reason to change his 2-year old estimate that by 1955, or thereabouts, there would be "400,000 registered civil aircraft in the U.S., with annual production of personal aircraft at that time of the order of 150,000," provided price drops 40 per cent.

Corporate Member News

● **Aeronca Aircraft Corporation** is first corporation to officially sign "War Department Affiliation Plan" contract. Calling for two units at Aeronca, designated 83rd Air Service Group and 96th Air Engineering Squadron, Fighter, contract was signed August 7. The two units eventually will be made up of 46 Reserve Officers and 666 Enlisted Reservists.

● **Aeroproducts Division,** General Motors Corporation, has developed hollow-steel brazed propeller blade that is filled with hard sponge rubber. New blade passed initial tests at Wright Field and Navy Aircraft Engine Laboratory at Philadelphia.

● **American Airlines System** has trained more than 900 pilots at its Ardmore, Okla., base during the past year. Ardmore staff of 175 employees handles about 135 students per month, including flight dispatchers, mechanics, stewardesses, and agents, in addition to pilots. . . . Company has signed for use of Westchester County (N.Y.) Airport, recently certified by C.A.A. as a provisional landing field for commercial transports. American spokesman indicated company will use facilities only when La Guardia and Newark fields are weathered in.

● **American Overseas Airlines, Inc.,** also signed for use of Westchester County Airport facilities as an alternate for La Guardia and Newark. Under C.A.A. certification, flights may be scheduled directly to and from the field.

● **Bendix Aviation Corporation** purchased the assets of Skinner Purifiers, Inc., Detroit, a pioneer in field of fine filtration equipment for automotive, aviation, and industrial uses. Skinner is to be operated as a new division of Bendix, increasing to 14 the number of Bendix divisions, exclusive of subsidiaries.

● **Boeing Aircraft Company** has developed an underwing fueling system that is said to enable Stratocruiser to be completely fueled with 7,620 gal. of gas in less than 15 min., speeding gas servicing by more than 60 per cent.

● **Breeze Corporations, Inc.,** declared 20-cent dividend payable September 10 to common shareholders on record September 2.

● **Consolidated Vultee Aircraft Corporation** is disposing of nonaviation interests and concentrating its activities in the field of aircraft manufacture. Move will "provide approximately $6,000,000 in cash during the present commercial aircraft production program"; will also serve to "reduce the outstanding capital stock of the corporation," company official said.

● **Douglas Aircraft Company, Inc.,** delivered last DC-4 Skymaster, reporting a total of 1,242 produced, more than 1,000 in use.

● **Eastern Air Lines, Inc.,** earned a net profit of $1,318,117 in first half of 1947.

● **Fairchild Camera & Instrument Corporation** netted a profit of $73,883 in first 6 months on net sales of $3,746,000, company reported.

● **Fairchild Engine & Airplane Corporation's** personal planes division has been established at Strother Field, Winfield, Kan., and is in production of spare parts for Fairchild models.

● **General Electric Company** reported a $39,979,536 profit for first 6 months of the year on net sales of $537,757,070.

● **Goodyear Tire & Rubber Company** purchased wartime plant operated by Goodyear Aircraft from War Assets Administration for $2,200,000; plans to use facility to expand production of transparent moisture-proof film and foamed Latex.

● **Jack & Heintz Precision Industries, Inc.,** peacetime successor of Jack & Heintz, Inc., reported a net income of $1,026,043 for 6 months ended June 30. Since operations of new firm began only in March last year, no comparable figures are available for same 1946 period.

● **Lockheed Aircraft Corporation** will extend its group insurance coverage for an employee's entire family effective January 1. Company will pay share of premium only for employee.

● **The Glenn L. Martin Company's** 2-0-2 has been approved by C.A.A. for air-line service—first postwar twin-engined transport to pass the new, more rigorous certification tests.

● **North American Aviation, Inc.,** has a launching tower under construction at Alamogordo Army Air Base, N.M., for its first experimental rocket, "NATIV" (North American Test Instrumental Vehicle).

● **Northwest Airlines, Inc.,** has adopted an all-telephonic reservations procedure whereby passenger at any station on transcontinental or Orient routes may obtain flight information in a matter of seconds. Communications clear through a master board at the Twin Cities Airport. . . . . Company moved its Seattle base of operations from Boeing Field to new airport at Bow Lake between Seattle and Tacoma September 1.

● **Pan American World Airways System** inaugurated the first regularly scheduled nonstop New York—London service August 29 with four new-type Constellations. . . . . Company will provide ground facilities and services for Australian National Airways at San Francisco Airport, with A.N.A. reciprocating at Sydney, Australia.

● **The Ryan Aeronautical Company** observed its 25th anniversary September 29.

● **Stinson Aircraft Division,** Consolidated Vultee Aircraft Corporation, has established regional sales headquarters at Oakland Airport to serve eight Western states, plus half of Wyoming.

● **Trans World Airline's** International Division offices have been moved from New York City to New Castle County Airport, Wilmington, Del.

● **United Aircraft Corporation** has paid almost $7,000,000 to employees under terms of group insurance policies since inception of first plan in 1928. . . . . Company has purchased East Hartford plant owned by the Government, which it operated during and since the war, for close to $20,000,000.

● **United Air Lines, Inc.,** which took over Western's Denver-Los Angeles service prior to September 17 following C.A.B. approval of purchase agreement, is transferring its general headquarters for operations and passenger service to Denver. . . . . United's new hangar at Chicago Municipal Airport, which will accommodate 3 DC-6's at same time, will be ready for occupancy about December 6. Second hanger, to be used jointly by United and Eastern, will be completed next spring.

● **Western Air Lines, Inc.,** moved its operations base to Bow Lake September 1.

● **Wright Aeronautical Corporation's** gas turbine, said to be first large engine of this type designed and built by American aviation industry, has been undergoing tests. Engine is a turboprop, reportedly of 7,500 hp.

Sections and Branches

Buffalo Section

Peter Tauson, *Secretary*

Two interesting talks on the helicopter were given at the June 19 meeting held in the Hotel Statler: one by Dr. Hans Lundberg, Geophysical Scientist and President and Manager of Hans Lundberg, Ltd.; the other by Owen Niehaus, Test Pilot (Helicopter), Bell Aircraft Corp.

Dr. Lundberg, Mining Engineer, Consulting Geophysicist, and Prospector, has been conducting aerial surveys of mineral deposits, using captive balloons, kites, airplanes, and helicopters. Title of his talk was "Use of Helicopters in Geophysical Surveys."

▸ **Helicopter Most Effective**—According to Lundberg, the helicopter has proved most effective for this purpose, particularly as a timesaving device. In a recent survey in northern Ontario of an area 12,000 by 10,000 ft., it required 70 days to prepare and complete magnetic operation utilizing the services of two engineers and two helpers, whereas a helicopter accomplished the same results in 1 hour, using only an engineer, observer, and pilot.

▸ **Manufacturer's Viewpoint**—Elaborating on Dr. Lundberg's talk, Niehaus ("Helicopter Operation and Maintenance") discussed the manufacturer's point of view, describing the operational and maintenance problem, operation of field shop, and methods of parts replacement to maintain the helicopter in flying condition for that type of service.

In addition, Niehaus related some experiences encountered in this survey from the pilot's point of view.

Following the talks, nominations for next year's officers were made. Dexter Rosen, Chairman, presided. Approximately 107 members attended.

Calendar

I.A.S. Section Meetings

BUFFALO—NOV. 21
Hotel Statler, Buffalo, N.Y.
Speaker: A. Flax and R. Allen Price
"Helicopters"

TORONTO—NOV. 19
Harthouse, University of Toronto
Speaker: J. T. Dyment
"Some Aspects of Air Transport Operations"

Dayton Section

E. W. Robischon, *Secretary*

High-speed seaplanes were featured in the talk of Dayton Section's speaker, Ernest G. Stout, at the August 28 meeting. Approximately 50 members and guests honored Mr. Stout, who is Chief, Naval Aircraft Research, Consolidated Vultee Aircraft Corp., at a dinner held at the Engineers Club prior to the technical session.

▸ **Hydrodynamic Development**—Mr. Stout's paper outlined the hydrodynamic development of flying boats through correlated free dynamic model tests, two basin tests, and actual flight tests.

The paper was illustrated by slides and two motion pictures. Of considerable interest were two views of a high-speed flying boat featuring blended aerohydrodynamic design, retractable steps and chine, turbojet power plants and lateral stability without tip floats.

One short film showed the catapulting of dynamic model flying boats to ascertain the landing stability characteristics as affected by trim angle and hull shape.

The Vice-Chairman, W. J. Blanchard, presided at the meeting.

San Diego Section

William B. Barkley, *Secretary*

Meeting July 25 in the Convair Cafeteria, with R. B. Johnston, Chairman, presiding, 120 members heard Frank W. Fink, Chief Engineer for Airline and Military Aircraft, Consolidated Vultee Aircraft Corp., speak on "Development of the Convair 240 Airline Transport."

▸ **Convair Liner Described**—Fink told of many of the outstanding design features incorporated in the Convair Liner. Because he has been in charge of the design of the transport since its conception, Fink was able to tell of the design problems that presented themselves, methods used in analyzing them, and how they were ultimately solved. With his paper, the speaker presented numerous color slides of the Convair Liner.

In addition to the paper, a film of the *Taxi and Initial Flight Tests of the Convair 240 Airline Transport* and the *Taxi and First Flight of the Convair XB-46 Airplane* were shown.

Alabama Polytechnic Institute

Winding up the Branch summer quarter meetings with three in Aug-

(*Continued on page 64*)

Royal Aeronautical Society's Garden Party, Radlett September 14, 1947

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The American Delegates and some of their hosts at the Garden Party at Radlett on the last day of the Conference. On this occasion, and also earlier in the week under the auspices of the S.B.A.C., the visitors were given an opportunity to see some of the latest British civil and military aircraft on the ground and in flight.

Mission Accomplished

For the past several months, at an accelerating pace, the transatlantic mails and cables have been busy with the final arrangements for the first Anglo-American Aeronautical Conference under the joint auspices of the Royal Aeronautical Society and the Institute. Now that the meetings are over, the American Delegates, to a man, are convinced that the concept was basically sound and that the execution was superbly carried out. Even under the somewhat strained economic conditions that now prevail in the United Kingdom, the traditions of British hospitality were fully maintained. We all came away with the feeling that we had profited greatly from the technical discussions, but more important still, that the bonds of Anglo-American understanding had been tremendously strengthened. In a world of political unrest and uncertainty, the by-product may well be of greater importance than the original objective.

It is to be hoped that last month's conferences will be the first of many. We are all looking forward to a return visit by our British friends in the not-too-distant future. Certainly, high standards have been set for us both in the field of technical interchange and in the arrangements that were made for the comfort and the convenience of the visiting delegates. Our friends of the U.K. have set us a real mark at which to shoot. When the time comes, however, we will be more than delighted to have a go at it.

On several occasions, the President of the Institute ably expressed appreciation of the American Delegates for the courtesies that were extended to us. Speaking now for the Officers, the Council, and the entire membership of the Institute, we all join in extending to the Senior Organization overseas our sincere thanks and our appreciation for the magnificent job that was done in London to make the first joint meeting of the Society and the Institute the success that it proved to be.

S. P. J.

Editorial

First Anglo-American Conference

I.A.S. — R.Ae.S.

London, England
September 2—14, 1947

Organization of First Joint Meeting Between the Institute of the Aeronautical Sciences and Its 81-Year Old Counterpart, the Royal Aeronautical Society, Provided Aeronautical Engineers of All Branches an Opportunity for Free Exchange of Ideas and Discussion of Pressing Technical Problems. Following Is a Chronological Recording of Papers Presented and Principal Events of the Meeting.

American Delegates

Via Pan American World Airways System, Flight 102, August 31

Among leading aeronautical engineers, scientists, and experts who participated in the joint Anglo-American meeting in London, ten are shown as they boarded a P.A.A. Clipper at La Guardia Field. Left to right: Rear Adm. Joseph Clark, U.S.N.; S. T. Robinson, Vice-President, Taylor Turbine Corp.; S. Paul Johnston, Director of I.A.S.; Mrs. Clark; R. W. Young, Vice-President of Engineering, Wright Aeronautical Corp.; Nicholas J. Hoff, Professor of Aeronautical Engineering, Polytechnic Institute of Brooklyn; R. M. Hazen, Chief Engineer, Allison Div., General Motors Corp.; Mrs. Hazen; W. K. Ebel, Vice-President—Engineering, The Glenn L. Martin Co.; Martin V. Kiebert, Jr., Consultant, Sherman Fairchild & Associates; Sherman Fairchild, Sherman Fairchild & Associates; and Grover Loening, Head Consultant, N.A.C.A. E. S. Thompson, General Electric Co., not shown in the group, also was a member of the party.

Via American Overseas Airlines, Inc., Flight 50, August 31

Delegates who flew to London on the American Overseas Airlines Flagship "Sweden" were (left to right): Preston R. Bassett, President, I.A.S., and President of Sperry Gyroscope Co., Inc.; Robert R. Dexter, Secretary of I.A.S.; William Enyart, President, Simmonds Aerocessories, Inc.; W. Wallace Kellett, President, Kellett Aircraft Corp.; Dr. Clark B. Millikan, Acting Director, Daniel Guggenheim Aeronautical Laboratory, California Institute of Technology; Earl D. Osborn, President, Edo Aircraft Corp.; and T. P. Wright, Administrator, C.A.A. Additional members of the party, not shown, were: J. S. McDonnell, President, McDonnell Aircraft Corp.; Mrs. Kellett; and Mrs. Enyart.

Joined American Party in London

On arriving in London, the delegates crossing the Atlantic by air joined with American delegates who had arranged their own passage. These included: H. J. Allen, N.A.C.A.; R. B. Beisel, United Aircraft Corp.; Lt. Col. J. H. Carter, U.S.A.F.; Lt. Robert Crawford, U.S.A.F.; I. H. Driggs, U.S.N.; R. L. Ely, A.M.C.; Allan D. Emil, Counsel, I.A.S.; Capt. J. L. Ewing, U.S.N.; R. R. Gilruth, N.A.C.A.; Gen. H. R. Harris, American Overseas Airlines, Inc.; Capt. J. J. Ide; R. P. Kroon, Westinghouse Electric Corp.; M. E. Oliveau, Douglas Aircraft Co., Inc.; Allen E. Puckett, California Institute of Technology; Col. O. J. Ritland, U.S.A.F.; Russell G. Robinson, N.A.C.A.; Igor I. Sikorsky, United Aircraft Corp.; Abe Silverstein, N.A.C.A.; Th. von Kármán; Major T. F. Walkowicz, U.S.A.F.

On Tuesday, September 2, the President of the Royal Aeronautical Society, Sir Frederick Handley Page, and the Council held a reception, at the Society's headquarters at 4 Hamilton Place, for all delegates to the Conference. A dinner, at which the President, Sir Frederick, and the Council and their ladies were present, was given the evening of September 3 for the American and British delegates. Following the ending of the Conference technical sessions on Friday, September 5, all the delegates were invited to a reception by the British government at Lancaster House.

The Technical Sessions

Opening Remarks

Sir Frederick Handley Page, President of the Royal Aeronautical Society, presiding at the opening session of the conference, welcomed the Institute of the Aeronautical Sciences to the meeting in the Victoria Halls. He was accompanied on the platform by Preston R. Bassett, I.A.S. President, and officers of the Society and of the Institute.

▸ **Happy Thought**—It was a very happy thought, Sir Frederick said, proposed as long ago as 1939 by Capt. J. Laurence Pritchard, Secretary of the Society, that as the years went by those who were concerned with aeronautics in Great Britain should work in closer cooperation with their friends across the Atlantic and that there could be no better way of doing it than by conferences dealing in engineering and scientific aeronautical thought in successive years or at intervals of 2 or more years.

Already there were many links, Sir Frederick continued, between the Society and the Institute. The Wilbur Wright Lecture to the Royal Aeronautical Society, in which the great pioneer of aviation was honored, had been delivered in Britain throughout a great number of years. Similarly, on the other side of the Atlantic, the Wright Brothers Lecture had been delivered on ten occasions.

▸ **Welcomes Bassett, Johnston**—In a personal welcome to Preston R. Bassett and S. Paul Johnston (President and Director, respectively, of the Institute), Sir Frederick recalled that he had been entertained by them in America; he was thus able to assure those who were contemplating a visit that when they arrived Mr. Bassett and Mr. Johnston would be there to ensure that they were well looked after.

In reply, Mr. Bassett thanked Sir Frederick and all members of the Society for the very fine welcome and hospitality extended to the delegation from America.

▸ **Looked Forward to Meeting**—Their meeting, declared Mr. Bassett, was the consummation of something to which they had looked forward for many years. They had aspired to it, for, after all, they were the junior members.

It was very fine, after many years of talk and planning—interrupted, of course, by emergencies—that at last they were all together with their British colleagues for a joint meeting. They had had to postpone matters by reason of the great emergency. But there seemed to be continued emergencies, and although the postponement could have been continued, they had doubted that it was worth while to look for any period of "interemergency" in this world in the near future!

▸ **Interchange of Information**—The delegates from America had not come to England in order merely to listen to the presentation of the papers and to say that the authors were right in what they had stated. They had come, Mr. Bassett said, to listen and to talk to their British colleagues, to interchange information on the work they were doing.

There was more than one solution to most problems, he continued; they were not attending the conference in order to find *the* solution but to compare notes on solutions.

As a good example of his theme, Mr. Bassett said that during the past 5 or 6 years our two countries had been engaged jointly in reducing the industry of our enemies. Each of us had had our own ideas, our ideas

Photos Courtesy The Aeroplane

did not conform; indeed our ideas were 12 hours apart, for one worked by day and the other by night. Fortunately, we had not to conform our ideas to a single plan; each of us learned from the other and we had gone into action with both plans, and the combination was superior to either. He hoped the result of the joint meeting would be the same.

September 3, 1947

Morning Session

South Hall

Chairman—*Sir Frederick Handley Page, President, R.Ae.S.*

Theoretical Considerations on High-Speed Flight Stability and Control, *by* Dr. Th. von Kármán, *Hon. F.I.A.S.*

(Paper not available at time of going to press.)

Control in Low-Speed Flight, *by* M. B. Morgan, *Sr. Principal Scientific Officer, Aerodynamics Dept. (Flight Section), Royal Aircraft Establishment.*

Noting that "low-speed flight" nowadays covers a much broader field than it did before the war, Morgan chose to discuss stability and control at speeds "uncomplicated by Mach Number and distortion effects."

His paper outlined "where we stand at present" and indicated "some of the directions in which we must travel in the next few years." The civil side of aviation was emphasized.

A picture of present trends in take-off and landing performance, based on results of examining the characteristics of a large number of transport aircraft—mainly British and American—for the period 1930 to 1947, was presented.

Some problems of ensuring that handling characteristics of unconventional shapes at low speeds are acceptable to pilots were treated. These included: (1) rapid variation in l_v over the speed range; (2) longitudinal instability near the stall; (3) difficulty in "holding off" just before landing, and (4) high stalling speed.

Morning Session

North Hall

Chairman—*Sir Oliver Simmonds, Vice-President, R.Ae.S.*

Modern Operational Factors Affecting Airworthiness, *by* K. T. Spencer, *Deputy-Director of Airworthiness, Ministry of Supply, and* P. A. Hufton, *Supt. of Performance, Aircraft and Armament Experimental Establishment.*

Rather than attempt to cover the whole field of operational factors affecting airworthiness, as implied in the title, authors Spencer and Hufton concentrated on one problem—temperature accountability—which they consider the most urgent.

Temperature accountability was defined as the "taking account, more accurately than is now done, of variations in an aircraft's performance arising from the fact that the atmosphere in which it flies will almost always be different from the theoretical international standard atmosphere on which performance estimates of aircraft are at present based."

Photo Courtesy The Aeroplane

S.B.A.C. Flying Display Party: *J. S. McDonnell, President, McDonnell Aircraft Corp., with Major Gen. Clayton L. Bissel, U.S. Military Air Attaché in Britain, at Society of British Aircraft Constructors' Flying Display and Show at Radlett, Sept. 9.*

The problem, according to Spencer and Hufton, arises most acutely when assessing maximum safe take-off weight. In their paper the authors analyzed the problem in relation to current international rules that permit either of two methods—geographical altitude method and equivalent density altitude method—to be used in assessing maximum safe take-off weight. Under either method, a large discrepancy in temperature may occur at certain airfields, particularly in tropical climates.

Furthermore, the variation of engine power with atmospheric density, pressure, and temperature being complicated, no one law of variation covers even all conventional types of piston engines. Introduction of turbojets introduces a still wider range of laws of variation.

This was discussed in some detail in the Appendix, which points up the fact that both the geographical altitude and equivalent density altitude methods are gross oversimplifications of an inherently complex situation. The question then arises whether these simplifications may lead to serious overloading of an aircraft. Examples of different types of aircraft were given to show that they may.

In their paper, Spencer and Hufton did not attempt to work out a complete scheme for dealing with temperature accountability; their aim was to set out the problem in the simplest terms and to indicate the directions in which solutions are likely to be found.

Icing Problems, *by* Abe Silverstein, *N.A.C.A.*

In his paper, N.A.C.A.'s Silverstein notes that, with safety for transport operations the primary objective, aircraft icing problems have been investigated with vigor at the major aircraft research laboratories in the United States and Great Britain for the past 15 years. The fundamental studies of Hardy and his coworkers at the Royal Aircraft Establishment and the experimental research of Rodert and the N.A.C.A. Ames Laboratory group on heat deicing have established methods for aircraft ice prevention on a sound engineering basis, he said.

Silverstein also briefly discussed requirements for maintaining ice-free surfaces on wings, propellers, windshields, and carburetors and reviewed the status of the icing problem for the turbine engine inlet.

However, while it is now possible to design with reasonable assurance of successful operation ice prevention for specified icing conditions, Silverstein declared, it is not possible to specify the icing conditions that may be encountered in all weather operations over world-wide transport routes. He presented limited data obtained from recent flights in the United States relating to the water content and drop size in icing clouds. Emphasis was placed on the necessity for the accumulation of statistical data in the characteristics of icing clouds so that the basic design conditions may be accurately specified.

Afternoon Session

South Hall

Chairman—*Rt. Hon. Lord Brabazon of Tara, Fellow, R.Ae.S.*

High-Speed Testing in the Southern California Cooperative Wind Tunnel, *by* Clark B. Millikan, *Acting Director, Daniel Guggenheim Aeronautical Laboratory, California Institute of Technology.*

Major constructional features and aerodynamic characteristics, which make the Southern California Cooperative Wind Tunnel particularly suitable for testing in the high subsonic speed range, were described by Dr. Millikan. Operating procedures and techniques that have been developed because of their special usefulness for such tests were discussed in detail.

Of particular interest, the device called the Lockheed "Bump," which makes it possible to obtain wind-tunnel data in a continuous series of Mach Numbers from 0.8 to as high as 1.1, was described and typical results obtained with it were reported.

In addition, calibration, operation, and data reduction procedures required for the obtaining and interpreting of experimental data at Mach Numbers near one were discussed. Effects of compressibility on blocking and other tunnel wall corrections were given special attention. Dr. Millikan also presented pertinent experimental results from a number of recent tests and the preliminary results of theoretical blocking calculations for swept wings and support struts.

High-Speed Performance, *by* W. G. A. Perring, *Director of the Royal Aircraft Establishment.*

In this paper, the Director of the Royal Aircraft Establishment limited his field to a discussion of high-speed subsonic problems, based for the most part on

work done at Farnborough. He made only brief references to new problems facing aviation as aircraft speeds increase and exceed the speed of sound.

Sketching in a broad background of the general trend of compressibility effects, Perring considered in more detail the effect of compressibility on the lift, drag, pitching moment, etc., of an aircraft.

Included in the paper were discussions of the influence of compressibility on design, characteristics of possible power units, airfoil characteristics, drag of bodies at supersonic speeds, and possibilities of supersonic flight. Numerous graphs and diagrams illustrated the subjects discussed.

Afternoon Session

North Hall

Chairman—*Sir Roy Fedden, Past-President of R.Ae.S.*

The Economics of Personal Aircraft, *by* Grover Loening, *Head Consultant, N.A.C.A.*

Probing into the economics of the operation of personal aircraft, Loening inquired whether the airplane, as a private vehicle, fills a need or a demand or a place in our economy. His analysis was optimistic, subject to improvements and new developments which will add to the utility of the personal plane and to reduction of costs to the personal aircraft owner.

Summarizing the limitations of personal planes, Loening listed four—airport locations, weather difficulties, skill required, and (the most serious) cost—which have "taken off the glow of the optimistic predictions and hopes of so many of us at the close of the war."

Without close-in airports, Loening pointed out, the private owner will find so limited usefulness to aircraft that "he will soon want to be selling it." Noise elimination is absolutely essential for the sound development of personal aircraft in that the principal objection to close-in airports will be removed.

Weather also is high on the list of serious limitations to private flying, with visibility being the chief problem to be solved.

Regarding the skill necessary to fly a plane, "so much constant progress is being made in perfecting the airplane's structure, particularly the controls and the landing gear, that this limitation is certain to become much less serious."

Cost, however, remains the most serious obstacle in the picture. A $2,500 plane, which costs some $2,200 annually to operate, requires its owner to have a net income of $9,000 per year, assuming one-quarter of his budget for transportation use. Therefore, the aviation industry has missed its mass production market entirely, for only a few hundred thousand persons earn a gross of $12,000 a year in America. It follows, therefore, that to get a production market costs must be lowered or justified.

To get into the field of real quantity production, according to Loening, designers and manufacturers must realize they are not in the business of selling an airplane as such to air enthusiasts but are in the business of delivering a method of transportation, a service, essential to our speeded-up tempo of life.

Electronic Control and Instrumentation of Aircraft, *by* Martin V. Kiebert, Jr., *Consultant, Sherman Fairchild & Associates.*

The increasing use of electronic techniques for the control and test of aircraft was pointed out in this paper.

The field of telemetering was discussed and described with regard to structural flight testing, missile instrumentation, and control of future potential application to air-carrier service.

Application of electronic equipment, particularly equipment of new and improved design, for control and stabilization of aircraft was treated. In addition, Kiebert briefly reviewed the means by which this equipment may be tied up with radio-control systems, together with the history of the art.

New air safety devices, such as may be provided by electronic aids, were also briefly discussed and described with projections made as to potential future applications of electronic techniques.

September 4, 1947

Morning Session

South Hall

Chairman—*N. E. Rowe, Fellow, R.Ae.S.*

Structural Problems of Large Aircraft, *by* Henry Knowler, *Director and Chief Designer, Saunders-Roe, Ltd.*

Design problems of large aircraft are no longer concerned principally with wing geometry but with the internal layout of the wing and its materials of construction, said Knowler. By proper design, range can be extended and pay load increased. The layout must take into consideration the balance of the wing, and its load concentrations must be so positioned that the best compromise will be obtained for the various flight conditions that will be met. The design strength of the wing must accommodate for the gust loads to be encountered.

Magnesium and aluminum alloys are basic aircraft construction materials because of their low weight. They can be most advantageously employed, however, only after their fatigue and fatigue recovery characteristics have been accurately determined, the author stated.

Thin-Walled Monocoques, *by* Dr. Nicholas J. Hoff, *Professor of Aeronautical Engineering, Polytechnic Institute of Brooklyn.*

Stressing the need for further alloy research, Dr. Hoff said a survey of the history of the development of thin-walled monocoque structures indicates that in the future changes can be expected in the details rather than the principles of their structural design.

New alloys are needed to boost the armament-carrying capacity of modern fighter planes. Structural efficiency also is likely to be improved further by the use of better methods of attachment of the structural elements and more suitable detail design based on an improved stress analysis. Present methods of determining scientifically the best locations for features such as gun mounts and glass "blisters" were deficient and required closer study, he said.

In his paper, Dr. Hoff described investigations that were carried out at the Polytechnic Institute of Brooklyn during and after World War II with the purpose of contributing to a better understanding of the stress distribution in, and the instability of, monocoques.

Individual problems treated in some detail in the paper were general instability, numerical methods of stress analysis, and stress concentrations caused by concentrated transverse loads in reinforced monocoque cylinders.

Morning Session

North Hall

Chairman—*Prof. A. A. Hall, Fellow, R.Ae.S.*

Analysis of N.A.C.A. Wing-Flow Tests, *by* Robert Gilruth, *Chief, Pilotless Aircraft Research Division, N.A.C.A.*

This paper is an account of the development of the N.A.C.A. wing-flow method for obtaining aerodynamic data through the speed of sound.

Characteristics of transonic flows produced in the model test region were discussed, and the behavior of airfoil models in passing through the sonic range were described and analyzed. In addition, data obtained on drag control effectiveness and trim characteristics were compared with pertinent data from free-flight and wind-tunnel techniques.

Practical Design Problems Arising from Sweepback, *by* E. J. Richards, *Chief Aerodynamicist, Vickers-Armstrongs Co. Ltd.*

A statement of the problems introduced by the use of the sweptback wing as a standard design feature for increasing the economical speed of aircraft is given in this paper. The use of sweepback requires a compromise between the resultant increase in weight of the wing and the increased critical Mach Number that is attained.

This choice is determined by the maneuverability and control characteristics that are required and by the aeroelastic effects. These characteristics were discussed for low speeds, subcritical speeds, and for speeds in excess of the critical Mach Number.

At high angles of sweepback, flaps produce no increase in lift, while at moderate angles there is such an increase. The problem therefore arises whether it would not be advisable to be satisfied with this moderate degree of sweepback, to take advantage of a gain of 0.03 to 0.05 in Mach Number, and to avoid the problems presented by tip stalling and aeroelasticity. Extensive wind-tunnel and theoretical research is still necessary, Richards declared, since present data are insufficient to enable the designer to take advantage of more than about half the gains that can be predicted for the sweptback wing.

Afternoon Session

South Hall

Chairman—*Sir Jonn S. Buchanan, Fellow, R.Ae.S.*

Some Novel Structural Properties of Stressed Skin Wings and Their Exploitation in Overcoming the Problems of Wing Flutter, Aileron Reversal, and Gust Loads, *by* D. Williams, *Senior Principal Scientific Officer, Structural and Mechanical Engineering Department, Royal Aircraft Establishment.*

Flexural torsion in an aircraft wing can be avoided, Williams said, by locating both the axis of inertia and the flexural axis at the aerodynamic center of the wing, which is very close to the quarter-chord position. Box beams can be considered as representative of stressed-skin wings. By use of the principles that apply to box beams, the axis of inertia can be located independently of the flexural axis either by arbitrary distribution of flanges and stringers of the distortionless section of the beam or by taking advantage of the characteristics of channel sections.

By the use of two ailerons instead of the usual single aileron, aileron reversal at high speeds can be avoided, according to the paper. Calculations were made on a hypothetical wing to show the variation of the flutter speed with the location of the flexural and the inertia axis.

A method of compensating for gusts was proposed which is direct acting and independent for each wing. A light flap of small chord is fitted along the entire length of the wing and is operated by the "kinematic" relative sliding action of the two free edges created when a torsion cell is slit along its whole length.

Some Aspects of Transport Airplane Development, *by* Arthur E. Raymond, *Vice-President—Engineering, Douglas Aircraft Co., Inc.*

Among the factors influencing the development of new transport airplanes, according to Raymond's paper (read by Mr. Oliveau), the factor of size has broad implications.

In his paper the initial determination of size as affected by policies of the customer and typical design considerations in relation to increased size, such as floor height, wing location, and control system, were discussed in general terms.

Afternoon Session

North Hall

Chairman—*S. Scott-Hall, Fellow, R.Ae.S.*

Helicopter Power-Plant Installations, *by* Robert M. Stanley, *Vice-President of Engineering, Bell Aircraft Corp.*

This paper is based on the experience gained by Bell Aircraft during the past 5 years in which at least eight different helicopter models have been, or are, in the process of development, utilizing some six different power-plant installations ranging in size from 150 to 550 hp. The discussion is confined principally to problems of piston engine installations which are generic to today's helicopters, avoiding the tendency to prognosticate upon the applications of jet propulsion to the helicopter.

Such items as weight, power required, rotor versus engine characteristics, rotor solidity, suspension systems, rigidly mounted pylons versus elastic installations, and the broader aspects of vertically mounted power plants provide a comprehensive survey of the major problems facing the helicopter designer of today.

September 5, 1947

Morning Session

South Hall

Chairman—*Major G. P. Bulman, Fellow, R.Ae.S.*

Personal Aircraft, *by* T. P. Wright, *Administrator, Civil Aeronautics Administration.*

Pursuing a subject similar to Grover Loening's paper, Wright outlined the "philosophy" of the personal plane. For success in the manufacturing field, he believes that "we must consider an aircraft that will meet the needs of the family." Potentially, the personal aircraft can easily become the most important factor in the aircraft industry.

Economic aspects were also discussed in some detail, including demand, ability to pay, cost reduction, and supply. In his Wilbur Wright Lecture in May, 1945, Wright forecast that by 1955, or thereabouts, "there would be 400,000 registered civil aircraft in the United States, with an annual production at that time of personal aircraft of the order of 150,000."

At that time he submitted a four-point program necessary in order to assure the attainment of these figures. This included an expansion of the airport system, a reappraisal of regulatory requirements, institution of educational and training aids, and an acceleration in the technical development of the personal aircraft itself.

According to Wright, satisfactory progress is being made in the first three items, but in the final phase, improvement in the utility of the plane itself, the need is great.

In this phase the factors of size, performance, cross-wind landing gear, safety, and roadability were discussed at some length, and these were recapitulated in a summary of characteristics.

With added utility, Wright declared, "a benevolent spiral of increased production and reduced price will result. On the assumption that the basic want or desire for flying is present in a very large number of people with ability to pay, it appears that this spiral will result in a will to spend which will produce the predicted increase in the importance of the personal aircraft field."

Photo Courtesy The Aeroplane

Page and Loening at Radlett: *Sir Frederick Handley Page, President of R.Ae.S., and Grover Loening, Head Consultant, N.A.C.A., at Radlett during Garden Party and Flying Display, Sept. 9.*

Rotor Systems and Control Problems in the Helicopter, *by* Raoul Hafner, *Chief Designer (Helicopters), The Bristol Aeroplane Co. Ltd.*

Representing a survey on problems that are met in the design and construction of rotors and their control mechanism, Hafner's paper, his first delivered before the Society since 10 years ago when he lectured on the "Gyroplane," offers an account of relevant experiences gathered in the last 10 years.

An attempt was made to present the subject in a form readily understandable to the aeronautical engineer who has not specialized in helicopter aeronautics.

Covering the numerous problems connected with helicopter design and construction in considerable detail—radial thrust grading and induced velocity of rotor, control of rotors, collective pitch control, rotor combinations, design details of rotor blades, to name only a few—Hafner offered some concluding remarks of nontechnical nature. Among these he mentioned that, although design and development costs for a modern helicopter are very high, the helicopter has, in common with the motor car, a large potential market, based on the following premises:

(1) The helicopter, if properly developed, can offer the fastest transportation for distances between 30 and 300 miles.

(2) While the helicopter does not possess the ubiquity of the motor car, it offers an enormous advance on the plane—landing places can be established not

only in country districts but in built-up areas in form of landing towers.

(3) The 'copter has the ability to move slowly or stop in any uncertainty or danger—this fact reflects not only safety but on regularity of service. Many air trips that are discontinued or never started could be completed if only in critical parts of the journey it was possible to reduce speed.

(4) The normal run-about-in-the-air will be comparatively simply equipped and simple to fly. It will be operated essentially like a car—i.e., flown under contact conditions, generally below 500 ft., and carry only the crudest blind-flying and homing gear as an aid for brief blind periods only.

Apart from these basic parameters, Hafner concluded, the market and cost for the helicopter will depend on manufacturing policy—it is his belief the largest market will be obtained if production is concentrated on a small number of carefully selected types.

Morning Session

North Hall

Chairman—*Dr. H. Roxbee Cox, President-Elect of R.Ae.S.*

Factors Effecting Future Development of Reciprocating Engines, *by* R. M. Hazen, *Chief Engineer, Allison Division, General Motors Corp.*

Some of the more practical factors having an adverse effect on the continued development of reciprocating engines were briefly outlined in Hazen's lecture. Among these factors mentioned were fuel logistics and availability, limitations on development funds, scarcity of materials, increase in pilotless aircraft applications, the influence of turbojet flight and development experience, and the complexities of development and installation of the compounded reciprocating engine.

In his paper the last point was expanded by outlining experience in the actual development of a compounded reciprocating engine and in its redesign for practical production use. Hazen concluded that the first stage of expansion is the limiting factor in making a satisfactory piston engine and that a high compression ratio simple turboprop can be developed to operate at the same combustor temperature in the same development time.

The advantages, therefore, are all with the turboprop engine even for very long-range use, he said. The advisability of expenditure of funds, engineering time, and know-how on further development of reciprocating engines is therefore dubious, Hazen concluded.

Turbine Engine Icing Problems, *by* A. G. Elliott, *Director and Chief Engineer, Rolls-Royce, Ltd.*

Prevention of ice formation is preferable to removal of ice after formation, because ice masses which have been removed can cause serious damage when they pass into the air intake, Elliott stated in his paper (read by Dr. Still).

Experience gained in the anti-icing of reciprocating engines can be applied, according to Elliott, to turbine icing problems. Useful data on the icing of debris screens and ice guards in intake systems and on the frequency of icing in flight also exists. Turbines can be protected in two ways, he said—either by heating the total volume of entering air or by heating the affected surfaces electrically or with hot gas.

The relative efficiency and economy of these methods were evaluated in their application to plain jet turbines of the axial-compressor type and to propeller-turbine and ducted-fan engines. Numerical data and graphs for typical conditions were introduced to show the requirements of each system.

Following an examination of various schemes for prevention of ice on wings and propellers, the results of tests performed on Derwent I, Derwent V, and Nene engines were reported. Test bed icing, methods for the distribution of hot gas, and artificial icing conditions with respect to temperature, concentration of water in the air, and water droplet size were investigated.

The paper concludes with remarks on controls for ice-prevention systems. An icing indicator was proposed which consists of a pitot tube with forward- and rear-facing holes. Blocking of the front holes occurs with icing, and the change to negative pressure in the tube, caused by suction from the rear holes, operates a switch that turns on the system. If, after subsequent heating of the tube, the ice reforms, the cycle is repeated until icing has ceased.

Afternoon Session

South Hall

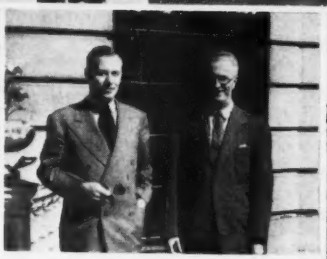
Chairman—*Sir Frederick Handley Page*

The Propeller Turbine Aero-Engine, *by* F. M. Owner, *Chief Engineer, The Bristol Aeroplane Co. Ltd.*

Only at the cost of great weight and complexity can reciprocating engines be designed to give the speeds and ceilings that are indicated by the present trends in aircraft, according to the author. This performance can be obtained most economically with the use of a power plant in which a turbine is employed both to provide exhaust thrust and to drive a propeller. The design of such a system was outlined.

The problem of matching the compressor and the turbine, the characteristics of axial and centrifugal compressors, the reduction gearing, and the importance of heat exchangers in thermal efficiency were treated in detail. Bristol propeller-turbine engines were used as examples.

Operation, control systems, and problems that were met in the manufacture of the components were described in detail. Nine diagrams illustrated installations in which two engines were coupled to drive the same propeller. Further development of the propeller-turbine power plant will not introduce radical changes, Owner said, but will improve its thermal efficiency and reduce fuel consumption.

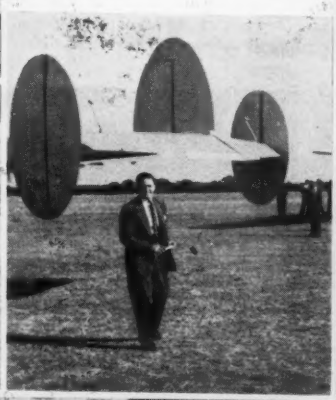


...when good fellows get together

Candid Shots of British and American Delegates at Sir Frederick's Garden Party on September 7; the Flying Display at Woodley Aerodrome; and the Party and Show at Radlett.

. . . from the camera of

Allan D. Emil



Other Special Events

September 6, 1947.—Garden Party by Reading Branch of the Royal Aeronautical Society. Flying Display of Miles Aerovan, Messenger, M.68 (experimental type), formation of three Geminis, the Marathon, and Merchantman.

September 7, 1947.—Garden Party at Limes House, Stanmore, for all delegates at invitation of Sir Frederick Handley Page and Lady Handley Page.

September 8, 1947.—Visit to Bristol Aeroplane Company, viewing the engine, helicopter, and air-frame sections.

September 9, 1947.—Visit to the Society of British Aircraft Constructors' Flying Display and Static Show at the Handley Page Aerodrome at Radlett. Dinner at Guildhall (see story, page 5).

September 10, 1947.—Visit to the Royal Aircraft Establishment, Farnborough. (The Establishment undertakes work similar to that done at Wright and Langley fields.)

September 11, 1947.—Visit to Saunders-Roe, Ltd. at Cowes, Isle of Wight. Delegates inspected mock-up and pressure test section of the SR/45, six-engined flying boat of 120 tons powered by turboprops of 5,000 hp. each.

September 12, 1947.—Visit to the National Gas Turbine Establishment at Whetstone to view government experimental establishment for jet engines.

September 14, 1947.—Society's Garden Party at Radlett.

American Delegates Tour British Plants: *Following the conclusion of the Technical Sessions, American Delegates were taken on an extensive tour of British aircraft factories and experimental establishments where they viewed the latest developments in British aeronautical science and production. The group is shown in front of the Bristol Aeroplane Co. Ltd.*

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50.	Full-Scale Free-Flight Ballistic Measurements of Guided Missiles—L. A. Delsasso, L. G. de Bey, and D. Reuyl, Ballistic Research Laboratories. 56 pages; 36 illus. (Printed.)	$0.50*
51.	Supersonic Aerodynamics—Principles and Applications—Theodore von Kármán, California Institute of Technology. 37 pages; 27 illus. (Printed.)	$0.50

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I.A.S. Briefs

Summaries of current papers received for publication or presentation at I. A. S. meetings

This Section gives advance and current information on papers presented to the Institute for publication or for presentation at meetings. Summaries of all pertinent papers, including those given at Section and Student Branch meetings, are published each month in these columns as rapidly as they are received from authors. All papers summarized in this issue were presented at the Annual Summer Meeting in Los Angeles.

Many of these papers, after being processed by the Editorial Committee in the usual manner, will appear in full in later issues of the JOURNAL *or* REVIEW.

Some specialized papers will be made available through the Sherman M. Fairchild Publication Fund. For detailed information regarding papers immediately available, *see page 23.*

The Analysis of a Circular Ring with Propped Floor Beam

By

J. S. Taylor and S. S. Gill

College of Technology, Manchester, England

The paper sets out a method of analyzing a circular fuselage former with a floor crossbeam supported by four vertical struts. The structure has eight redundancies, but from symmetry of loading and geometry there are only five unknowns to be evaluated by strain energy methods.

The general equation for the bending moment and the partial differential coefficients with respect to the unknowns are stated in tabular form. This assists computation.

An Approximate Solution to the Integral Equation for an Oscillating Airfoil in Subsonic Flow

By

John W. Miles

University of California

Following a procedure analogous to that used by Schwarz in solving Birnbaum's integral equation for the pressure distribution on an oscillating airfoil in an incompressible flow, Possio's integral equation for the same problem in a subsonic compressible flow is solved approximately by expanding the kernel in a power series and dropping terms of the order M^4, where M is Mach's modulus. The results are used to obtain the lift, pitching moment, and hinge moment due to plunging, pitching, and aileron flapping. The solution for higher order approximations is discussed in an appendix. Three other methods of solution of the Possio integral equation are also discussed in appendixes.

A Simplified Method of Obtaining Drag of a High-Speed Body from Wake Surveys

By

Chieh-Chien Chang

The Glenn L. Martin Company

In the light of the known experimental fact, that nearly constant stagnation temperature exists across the wake of a body moving at high speed in air, Jones' drag integral equation is re-examined, and it is found that the integrand of the equation can be separated into the product of two functions: one function containing the ratio of the static to total head pressure at the measuring station in the body's wake, and the second function containing two similar pressure ratios that correspond to conditions far up and far downstream along the same streamline. Each of the two functions can be conveniently plotted in a graph. With the aid of such graphs, this analysis makes the pitot-traverse method practical and easy to apply in determining drag of flight at subsonic speed. An example of the application is shown. Some justifications of the assumption are made, and the limitations of application are explained.

It is further found that the method can be applied approximately to flow around a two-dimensional body with shock and possibly to supersonic flow, as long as at and behind the measurement station no shock waves of appreciable strength exist. Of course, some development work has to be done before this method can be successfully applied to the supersonic case.

Gasdynamic Aspects of Combustion in Jet Propulsion

By

D. G. Samaras

National Research Council, Ottawa, Canada

Present-day performance considerations call for substantial improvements in the combustion process. Fundamental

work on heat addition in ducts and flame fronts has resulted in a better understanding of combustion. Vorticity and turbulence are responsible for a large increase in the combustion rate. Fluid oscillations and resonance effects may be responsible for the flame instability phenomena encountered at high altitudes. Complete physical similarity requires the satisfaction of a large number of nondimensional parameters. Since this is impossible in practice, an approximate similarity should be sought.

The Decay of Isotropic Turbulence

By

F. N. Frenkiel

Cornell University

The equation of decay of isotropic turbulence is determined in the two cases of large and small Reynolds Number of turbulence by using the von Kármán-Howarth equations and applying Loitsianskii's theorem of the conservation of the disturbance moment. The theoretical curves are compared with the results of measurements behind grids made by various experimenters in the United States and in England. The decay of the longitudinal turbulent energy seems to agree well with the theoretical equations for large Reynolds Number of turbulence.

The theory does not give the variation of the transverse scale of turbulence measured in the experiments but only the *disturbance length*, which is a function of the longitudinal correlation. Thus, the comparison for the scale is deduced from the equations. The difference is explained by the imperfect isotropy, which has a much greater influence on the variation of the scale than it has on the energy decay.

The present comparison of the theory with the experiments differs from similar prior comparisons in the fact that the decay is given as a function of the initial conditions of the turbulence at a chosen moment, without using arbitrary constants.

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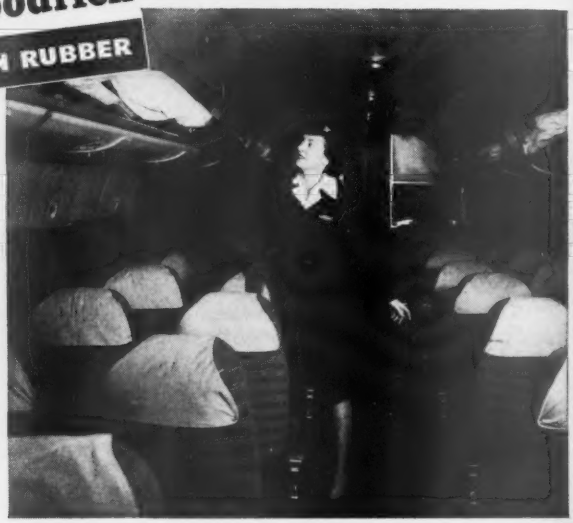

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Aeronautical Reviews

Acoustics

Propagation of Sound About a Rapidly Moving Object. Ludwig Prandtl. (*Deutsche Akademie der Luftfahrtforschung*, February, 1938.) *U.S., Army Air Forces, Translation No. F-TS-3035-RE*, June, 1947. 11 pp., figs.

Aerodynamics

The Ring Airfoil in Nonaxial Flow. Herbert S. Ribner. *Journal of the Aeronautical Sciences*, Vol. 14, No. 9, September, 1947, pp. 529, 530, fig. 4 references.

The ring airfoil with axis inclined to the stream is investigated by a lifting-line theory. The stream tube that threads the ring is found to deflect like a rigid cylinder. The lift is twice the lift of a flat elliptic wing that spans a diameter and has a quarter the area, and the down-wash and ratio of lift to induced drag are the same for both.

An Approximate Solution to the Integral Equation for an Oscillating Airfoil in Subsonic Flow. John W. Miles. *University of California.* (For abstract see "I.A.S. Briefs" on page 24 of this issue, October, 1947.)

A Simplified Method of Obtaining Drag of a High-Speed Body from Wake Surveys. Chieh-Chien Chang. *The Glenn L. Martin Co.* (For abstract see "I.A.S. Briefs" on page 24 of this issue, October, 1947.)

The Decay of Isotropic Turbulence. F. N. Frenkiel. *Cornell University.* (For abstract see "I.A.S. Briefs" on page 25 of this issue, October, 1947.)

Summary of Airfoil Data. Ira H. Abbott, Albert E. von Doenhoff, and Louis S. Stivers, Jr. *U.S., N.A.C.A., Advance Confidential Report No. L5C05 (Wartime Report No. L-560)*, March 1945. 482 pp., figs., tables. 90 references.

The airfoil data that the National Advisory Committee for Aeronautics has obtained since 1929 in the course of its systematic investigation of a family of airfoils have been compiled into a basic reference work. The text traces the development of the airfoils, which are designated by five, six, and seven digits, from the original family of airfoils, which was designated by four digits. The significance of the designation of each series is explained, showing the characteristics that have been used to establish a classification system. In a general discussion of airfoils, methods are given for deriving the thickness distribution, for estimating the pressure distribution, and for determining the critical Mach Number and the moment coefficients. The summary of experimental data that was obtained from wind-tunnel and flight tests includes, in its treatment of drag, the effect of surface finish and the actual drag characteristics of wings produced by commercial production methods. In the section on lift, the summary takes up, in addition to the normal wing, the behavior of high-lift and lateral control devices. The method of computing lift and drag data from pressure measurements taken in the Langley two-dimensional low-turbulence tunnels and the correction calculations which are required are given in the appendix. The section of the report headed "Supplementary Data" consists of tables and graphs for the basic thickness forms, the mean lines, the predicted Mach Numbers, and the aerodynamic characteristics of the various airfoils and families of airfoils that have been developed.

Velocities and Speeds Through A Shock Wave. A. Thom and P. R. Owen. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2044*, April, 1943. 9 pp., illus. 4 references. British Information Services, New York, $0.60.

The relation between the velocity vectors on the two sides of a shock wave are presented in graphical form. Two cases are considered, a single straight or oblique and a double shock. Where photographs are available, the curves can be used to deduce the speeds and pressures in the vicinity of the shock waves.

On the Two-Dimensional Steady Flow of a Compressible Viscous Fluid Far Behind a Solid Symmetrical Body. M. Z. Krzywoblocki. *The Franklin Institute, Journal*, Vol. 243, No. 6, June, 1947, pp. 471–486.

The method of successive approximations used by S. Goldstein in the solution of the incompressible case is used in the solution of the equations of steady flow of a viscous fluid. The following equations are taken into account: equations of motion, continuity, energy, and state. The coefficients of viscosity and thermal conductivity are assumed to be functions of temperature. The first two, but not the third, of the successive approximations were found to be successful.

The Subsonic Flow About a Body of Revolution. E. V. Laitone. *Quarterly of Applied Mathematics*, Vol. 5, No. 2, July, 1947, pp. 227–231, figs.

Compressible Potential Flow with Circulation About a Circular Cylinder. Max A. Heaslett. *U.S., N.A.C.A., Advance Restricted Report No. 4AO8 (Wartime Report No. A-42)*, January, 1944. 30 pp., figs. 14 references.

Analytical Treatment of Normal Condensation Shock. (*Peenemünde, Heeresversuchsstelle, Archiv Nr. 66/72*, March 30,

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1942.) *U.S., N.A.C.A., Technical Memorandum No. 1174,* July, 1947. 28 pp., figs.

Schlieren photographs of supersonic flows in two-dimensional Laval nozzles show two intersecting oblique shock fronts that, in the case of high humidities, may merge near the point of intersection into one normal shock front. Downstream of a normal condensation shock, the pressure, the density, and the temperature decrease more sharply with increasing nozzle cross section, and the Mach Number and the velocity increase more sharply than in the absence of shock.

Examples of the Application of Busemann's Formula to Evaluate the Aerodynamic Force Coefficients on Supersonic Aerofoils. C. N. H. Lock. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2101,* September, 1944. 10 pp., tables. 5 references. British Information Services, New York. $0.90.

Busemann has given an expression in the form of an expansion in powers of the angle of inclination for the pressure, in two-dimensional supersonic flow, on a surface inclined at a small angle to the free stream. The first two terms of this expansion are applied to give explicit algebraic formulas for the lift, drag, and moment coefficients of an airfoil whose surface is composed entirely of segments of straight lines and circular arcs. Examples are worked out in detail for the symmetrical double-wedge section, the chambered biconvex section, and the symmetrical double wedge with a hinged flap at the trailing or at the leading edge. A numerical example is worked out for an antisymmetrical shape, the faired double wedge.

Method of Characteristics for Two-Dimensional Supersonic Flow—Graphical and Numerical Procedures. Ascher H. Shapiro and Gilbert M. Edelman. *Journal of Applied Mechanics,* Vol. 14, No. 2, June, 1947, pp. A-154–A-162, figs., tables. 6 references.

A review and summary of the method of characteristics for two-dimensional supersonic flow. A characteristics chart is given for use with the graphical procedure of Prandtl and Busemann. A numerical procedure is described which allows of more accurate solutions. A table of functions is included.

Calculation of Compressible Flow Past Aerodynamic Shapes by Use of the Streamline Curvature. W. Perl. *U.S., N.A.C.A., Technical Note No. 1328,* June, 1947. 91 pp., figs. 14 references.

An assumption is made as to the variation of the curvature of the streamlines in the flow field, and the equations of motion (which are expressed in terms of the streamline curvature) are integrated. The limiting solution for potential flow is identified with the "limiting line" phenomenon and discussed in relation to the flow through a converging-diverging channel. This method of calculating compressible-flow velocity distributions yields results for symmetrical sections in satisfactory agreement with existing results based on calculations to the third order in the thickness ratio. The method appears to be applicable to any subsonic or supersonic flow problem in which a satisfactorily accurate estimate of the curvature of the streamlines can be made in the portion of the flow field of interest.

On the Problems of Chaplygin for Mixed Sub- and Supersonic Flows. F. Frankl. (*U.S.S.R., Akademiia Nauk, Izvestiia,* Vol. 9, 1945, pp. 121–143.) *U.S., N.A.C.A., Technical Memorandum No. 1155,* June, 1947. 36 pp., figs. 7 references.

Chaplygin's development for subsonic flow reduces to the problem of Dirichlet and can be solved by a series combined from the special solutions of one of the forms of the basic equation for the stream function. Using the work of Tricomi, the author has found a formulation and established the singularity of the solution of this problem and that of the boundary conditions for the equation for the stream function in mixed sub- and supersonic flow.

Some Aerodynamic Relations for an Airfoil in Oblique Flow. F. Ringleb. (*Deutsche Luftfahrtforschung, Forschungsbericht Nr. 1497,* Oct. 21, 1941.) *U.S., N.A.C.A., Technical Memorandum No. 1158,* June, 1947. 20 pp., figs.

The ratio of the lift and the moment coefficients are derived for two airfoils, infinite in extent, one of which is in straight flow and the other in oblique flow. Both profiles have the same maximum thickness in the direction of flow. Theoretical results are compared with measurements conducted at the Aerodynamic Institute of the Technische Hochschule of Aachen on sweptback wings

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Compression Shocks of Detached Flow. Eggink. (*Deutsche Luftfahrtforschung, Forschungsbericht Nr. 1850.*) *U.S., N.A.C.A., Technical Memorandum No. 1150*, June, 1947. 25 pp. illus.

Compression shocks that mark the transition from supersonic to sonic velocities cause the flow to separate on contact with a rigid wall. Schlieren observations show a branching of the compression shock. The flow in the vicinity of the branching point is computed, and the results are presented in a shock-polar diagram.

The Representation of Aerodynamic Derivatives. G. Temple. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2114*, March, 1945. 12 pp., diagrs. 13 references. British Information Services, New York. $0.75.

A summary of the various mathematical representations of the aerodynamic forces as affected by small disturbances resulting from some prescribed motion of an airplane and the corresponding representations of the solutions of the equations of motion.

On the Theory of the Unsteady Motion of an Airfoil. L. I. Sedov. (*Tsentral'nyi Aero-Gidrodinamicheskii Institut.*) *U.S., N.A.C.A., Technical Memorandum No. 1156*, July, 1947. 68 pp., figs. 18 references.

The nonstationary flow of an infinite fluid about an airfoil producing a system of vortexes and the hydrodynamic forces acting on the airfoil are determined. The hydrodynamic problem is reduced to the determination of a function that transforms conformally the external region of the airfoil into the interior of a circle. Simple methods are developed for determining the irrotational flow that is produced by any motion of the airfoil when the function is rational. The analysis is illustrated by the computation of the forces acting on a plate when the fluid contains only a single vortex filament.

Considerations of the Total Drag of Supersonic Airfoil Sections. H. Reese Ivey and E. Bernard Klunker. *U.S., N.A.C.A., Technical Note No. 1371*, July, 1947. 16 pp., figs. 9 references.

A preliminary study of the total drag of a two-dimensional airfoil. In order to demonstrate the effects of viscous and pressure drag on the total drag, calculations are presented for two 6 per cent thick airfoil shapes, a double circular arc, and a symmetrical wedge with maximum thickness at the 50 per cent chord.

Comparison Between Different Methods of Calculating the Profile Drag as Determined by the Pitot Traverse Method at High Speeds (Jämförelse Mellan Olika Metoder för Utvärdering av Profilmotstaand ur Impulsmätning vid Höga Hastigheter). G. Drougge. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 21 (FFA-Rapport AE-95)*, 1946. 12 pp., figs. Kr. 1:50. (In Swedish.)

Six different methods were used to compute the profile drag of a model wing with an NACA 0012 profile and a chord of 14 cm. Experiments were conducted in the high-speed tunnel of the Aeronautical Research Institute of Sweden. Neglecting compressibility, Jones's method and the method according to Silverstein-Katzoff were carried out and compared with the results from the same methods when they were corrected for compressibility. These methods, when corrected, gave good values over the whole Mach-Number range. Greater accuracy was obtained by using the method according to Young and that according to Lock-Hilton-Goldstein for compressible flow.

A New Device for Determining Wing Profile Drag by the Pitot Traverse Method (Bestämning av Profilmotstaand hos Vingmodeller Genom Impulsmätning med Integrerande Mätsond). B. Reistad. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 8 (FFA-Rapport AE-39)*, 1945. 10 pp., illus. 6 references. Kr. 1:50. (In Swedish.)

The device is intended as a suitable substitute for the integrating rake described by Doetsch in 1937 and by Silverstein and Katzoff in 1940. It consists of a total-head tube driven by a motor at a constant speed to and fro over the area being measured. The tube is connected to an equalizing pressure vessel, giving the mean total head over the area. Results of tests recounted in this report show an error of minus 2 per cent. This error, however, has since been eliminated, and the device now operates without systematic error.

Flight Investigation of the Variation of Drag Coefficient with Mach Number for the Bell P-39N-1 Airplane. Welko E. Gasich and Lawrence A. Clousing. *U.S., N.A.C.A., Advance Confidential Report No. 5D04 (Wartime Report No. A-61)*, May, 1945. 29 pp., illus. 10 references.

Correlation of the Drag Characteristics of a P-51B Airplane Obtained from High-Speed Wind-Tunnel and Flight Tests. James M. Nissen, Burnett L. Gadeberg, and William T. Hamilton. *U.S., N.A.C.A., Advance Confidential Report No. 4K02 (Wartime Report No. A-62)*, February, 1945. 31 pp., illus. 3 references.

Measurements of the Pressure Distribution on the Horizontal-Tail Surface of a Typical Propeller-Driven Pursuit Airplane in Flight. I—Effects of Compressibility in Steady Straight and Accelerated Flight. Melvin Sadoff, William N. Turner, and Lawrence A. Clousing. **II—The Effect of Angle of Sideslip and Propeller Operation.** Melvin Sadoff and Lawrence A. Clousing. *U.S., N.A.C.A., Technical Notes Nos. 1144, 1202*, July, May, 1947. 79, 51 pp., illus. 7, 5 references.

I. In steady straight and accelerated flight, a comparison of experimental results with the calculated horizontal tail loading showed that the calculated compressibility corrections were small and could be neglected except at the critical down-load conditions. Because of variations in the tail-off moment coefficient at zero lift and the variations in airplane stability, the computed tail loads failed to predict the changes in actual loading at the higher Mach Numbers. The calculated root bending moments were unconservative as compared with the experimental values, except at the highest speeds where the actual center of pressure on the left and right tail moved inboard of the calculated value. The calculated asymmetric loads and fuselage torsional moments were conservative. The specified chordwise distribution of the balancing tail loads over the horizontal-tail surface was considerably in error because the actual section angle of attack was not constant across the tail span and because the elevator angle was not taken into account in distributing the chordwise loads.

II. A comparison of the experimental results obtained for the effect of angle of sideslip and propeller operation showed that the calculated values of asymmetric tail load and the resultant fuselage torsional moment are conservative for critical flight conditions. The calculated root bending moment, however, may be unconservative by as much as 25 per cent as compared with the actual value for critical flight conditions.

Comparison Between the Measured and Theoretical Span Loadings on a Moderately Swept-Forward and a Moderately Swept-Back Semispan Wing. Robert A. Mendelsohn and Jack D. Brewer. *U.S., N.A.C.A., Technical Note No. 1351*, July, 1947. 71 pp., illus. 4 references.

Report of an investigation in the Langley stability tunnel of two semispan swept-wing models to determine experimentally the

The irregularity of receipt of publications from abroad necessitates the review of articles in issues several months late. This is done to provide readers with information regarding foreign technical progress as soon as the issues are available in the United States.

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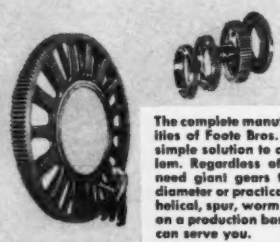

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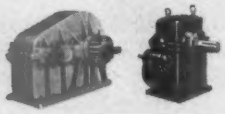

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span-load distributions and to compare the experimental with the theoretical results. One wing was swept forward 12°, and the other was swept back 23° at the quarter-chord line. In order to check the validity of the semispan tests, the full-span sweptback wing from which the semispan model was made was first tested in the Langley propeller-research tunnel. The differences between span loadings determined from tests in two wind tunnels were small, but they were as great as the differences between span loadings determined from a lifting-line and lifting-surface theory. The theoretical curves approximated the experimental ones with accuracy sufficient for engineering calculations. A small loss in load, presumably caused by the tunnel-wall boundary layer, occurred near the root for both semispan wings. Because of this loss in load and because of distortions on the chordwise loading near the root, semispan tests of highly swept wings may give errors in pitching moment. The aerodynamic center of both semispan wings moved forward at high lift coefficients.

Wind-Tunnel Investigation of Split Trailing-Edge Lift and Trim Flaps on a Tapered Wing with 23° Sweepback. William Letko and David Feigenbaum. *U.S., N.A.C.A., Technical Note No. 1352*, July, 1947. 72 pp., illus. 2 references.

In connection with the study of high-lift flaps for all-wing airplanes, wind-tunnel force tests and pressure-distribution measurements were undertaken to determine the effects of size and hinge location of lift and trim flaps on the lift and pitching-moment characteristics of a semispan tapered wing with 23° sweepback of the quarter-chord line.

Wind Tunnel Tests of Tapered Wings with Various Amounts of Dihedral and Sweep-Back (Aerodynamisk Undersökning av Trapetsvingar med Olika V- och Pilform). O. Holme. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 17 (FFA-Rapport AE-47)*, 1946. 24 pp., diagrs. 5 references. Kr. 2:50. (In Swedish.)

Six-component measurements and flow investigations were made with six tapered wings with various angles of dihedral and sweepback at angles of yaw up to 20°. A comparison between the test results and the calculated values of the increase in lateral force, rolling moment, and yawing moment caused by dihedral and sweepback showed that there was qualitative agreement in all cases except for the relation between moment of yaw and dihedral angle. In this case theory and experiment gave opposite results.

Pressure-Distribution Measurements on Unyawed Swept-Back Wings. W. Jacobs. (*Braunschweig, ZWB/UM Nr. 2052*, December 21, 1943.) *U.S., N.A.C.A., Technical Memorandum No. 1164*, July, 1947. 30 pp., illus. 15 references.

Comprehensive pressure-distribution measurements were made on four sweptback wings with sweepback angles of 0°, 15°, 30°, and 45°. The chord was constant. Measurements were taken over a large range of angles of attack in symmetrical airflow. Theoretical results calculated by the method of Weissinger compared more favorably with the experimental results than did those obtained by using Mülthöpp's method.

An Investigation of the Influence of Turbulence on the Transition Point on an Aerofoil (Undersökning av Turbulensens Inverkan paa Omslagspunktens Läge paa en Vingprofil). G. Drougge. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 20 (FFA-Rapport AE-24:4)*, 1946. 25 pp., diagrs. 13 references. Kr. 3:-. (In Swedish.)

Transition in the boundary layer in a turbulent air stream will occur when the fluctuating pressure gradients have a sufficiently high positive value. The magnitude of this value at a point on an airfoil may be equal to the difference between the value of the gradient at this point (which had been considered necessary to cause laminar separation) and the value of the gradient at the same point of the existing pressure distribution. Since these fluctuating gradients cannot be measured directly, it is proposed instead that the difference is not equal but only proportional to the root-mean-square values of these gradients. In the wind tunnel it was possible by means of grids that produced turbulence to determine the position of the transition point as a function of several different degrees of turbulence and different velocities of the free stream. From these positions it was possible to calculate the value of the root-mean-square for the different points along the surface and to verify the assumptions.

Analysis of the Turbulent Boundary Layer for Adverse Pressure Gradients Involving Separation. W. S. Coleman. *Quarterly of Applied Mathematics*, Vol. 5, No. 2, July, 1947, pp. 182–216, figs.

The derivation of a theoretical formula for the development of the turbulent boundary layer. From the fundamental equations of motion an expression is established analogous to certain differential equations of an empirical character which have been advanced by von Doenhoff and Tetervin and by Garner. Although it is analytically different from the expression proposed by these authors, the theoretical formula contains the same parameters.

The Effect on Drag of the Ejection of Air from Backward-Facing Slots on a 16.2 per cent. Griffith Aerofoil. J. H. Preston, W. S. Walker, and C. R. Taylor. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2108*, January, 1946. 7 pp., figs. 5 references.

If separation of the boundary layer is prevented by blowing, about two and one-half times more air is required than when suction is used. In order to gain, with blowing, the same reduction of drag that is obtained with suction when separation is just prevented, seven times the amount of air is used. From a purely aerodynamic point of view, suction is to be preferred because potential-flow conditions over the rear of the wing are closely attained. With blowing, these conditions are not likely to be produced and considerable form drag may result.

Drag Reduction by Suction of the Boundary Layer Separated Behind Shock Wave Formation at High Mach Numbers. B. Regenscheit. (*ZWB, Forschungsbericht Nr. 1424.*) *U.S., N.A.C.A., Technical Memorandum No. 1168*, July, 1947. 18 pp., illus. 5 references.

Test results showed that the drag that arises at high velocities can be reduced considerably by removing the boundary layer by suction at a point just behind the shock waves that are formed.

Studies Substantiate Theory of Laminar-to-Turbulent Flow. *Aviation Week*, Vol. 47, No. 3, July 21, 1947, pp. 28, 31, diagrs.

A description of a boundary-layer investigation made by the National Bureau of Standards. Periodic disturbances introduced in the boundary layer gave results that verified boundary-layer separation criteria propounded by Tollmien and Schlichting. Results also indicated that transition from laminar to turbulent flow may be effected by air-frame vibration and by sound.

Test Report on Three- and Six-Component Measurements on a Series of Tapered Wings of Small Aspect Ratio (Partial Report, Elliptic Wing). Lange and Wacke. (*ZWB/UM/1023/3*, September 23, 1943.) *U.S., N.A.C.A., Technical Memorandum No. 1146*, June, 1947. 48 pp., illus.

Results of wind-tunnel tests conducted with tapered wings having an NACA 0012 profile and an aspect ratio that varies from 1 to 2 with the sweepback. The influence of the sweepback and the contour upon the neutral point is shown.

Test Report on Measurements on a Series of Tapered Wings of Small Aspect Ratio. Lange and Wacke. (*ZWB/UM/1023/2*, September 17, 1943.) *U.S., N.A.C.A., Technical Memorandum No. 1129*, July, 1947. 47 pp., illus.

The trapezoidal wings reported on in the first paper of this series were tested again under identical conditions but in the presence of the fuselage. Three-component measurements showed that the fuselage caused no fundamental changes in the forces and moments with respect to the angle of attack. Drag increase because of the fuselage was not observed. Six-component measurements showed that lift and drag are nearly independent of the yawed flow. The marked drop in lift coefficient which had been observed at high angle of attack was considerably reduced by the presence of the fuselage.

An Investigation of Unsymmetrical Stalling of Aircraft Wings (Undersökning Beträffande Osymmetrisk Överstegring vid Flygplanvingar). E. Petersohn. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 9 (FFA-Rapport AE-42)*, 1945. 12 pp., diagrs. Kr 1:50. (In Swedish.)

Investigation of the stall characteristics of a model two-engined airplane showed that the wing was divided by the nacelle and the fuselage into four parts that stalled alternately within a certain range of angles of incidence. Experiments with model wings using chordwise rectangular plates to represent the fuselage and nacelles showed that asymmetrical stalling was obtained within a certain range of incidences. It is assumed that when stalling begins on one side of the plate it cannot spread to the other side. This results in a discontinuity in the lift distribution which causes a vortex. The vortex causes an induced speed disturbance, which increases the angle of incidence on the stalled side and lessens it on the other side.

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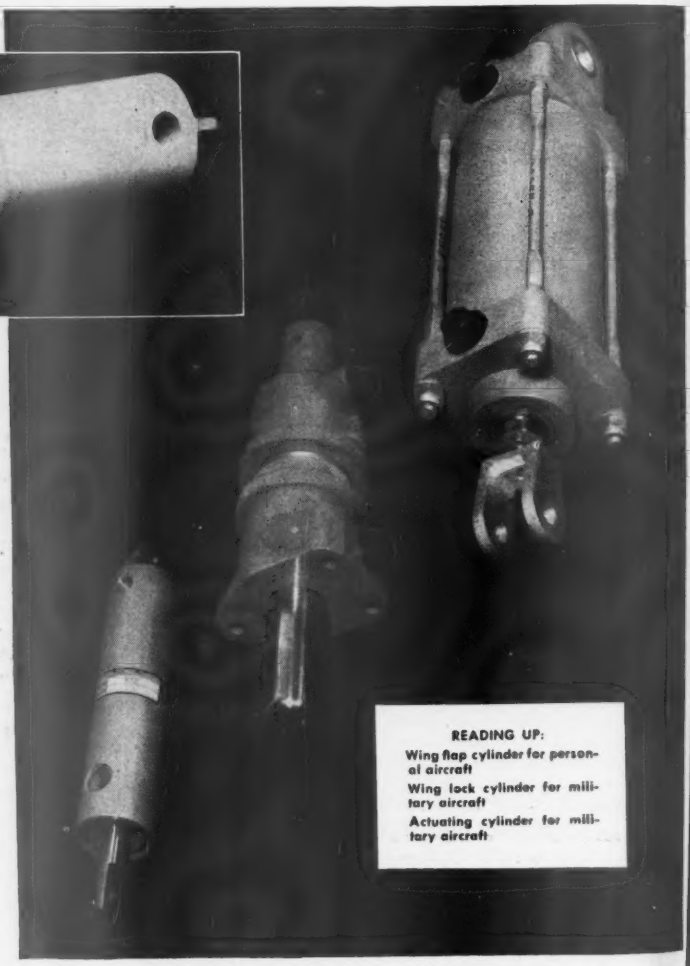

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Stalling Phenomena and the Tailless Aeroplane. IV. A. R. Weyl. *The Aeroplane*, Vol. 72, No. 1881, June 27, 1947, pp. 685–687, illus. (Cf. AER 9/47:37.)

Stability of the aircraft under stalling conditions exists when the aerodynamic center of gravity shifts forward, thus producing a tail-heavy trim. In the case of sweptback wing systems, the premature stall that occurs at the wing tips increases in severity with increase in the angle of effective sweepback. The lift curves of such a wing system have two peaks, and with increasing sweepback the curve becomes more gradual at the stall and free from abrupt discontinuities.

Wing-Fuselage Interference—Comparison of Conventional and Airfoil-Type-Fuselage Combinations. Eastman N. Jacobs and Albert Sherman. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. L-509)*, March, 1937. 11 pp., illus. 5 references.

Full-Scale Tunnel Measurements of the Pressures on the Elevator and Fuselage of the Curtiss XP-55 Airplane. Richard C. Dingledein. *U.S., N.A.C.A., Memorandum Report (Wartime Report No. L-630)*, June, 1943. 52 pp., illus., tables. 4 references.

Effect of Geometric Dihedral on the Aerodynamic Characteristics of Two Isolated Vee-Tail Surfaces. Robert O. Schade. *U.S., N.A.C.A., Technical Note No. 1369*, July, 1947. 18 pp., diagrs. 2 references.

Force tests conducted on two isolated V-tail surfaces with various amounts of dihedral showed good agreement with theoretical calculations contained in N.A.C.A. Advance Confidential Report No. L5A03 (Wartime Report No. L-212).

Analysis of Available Data on Control Surfaces Having Plain-Overhang and Frise Balances. Paul E. Purser and Thomas A. Toll. *U.S., N.A.C.A., Advance Confidential Report No. L4E13 (Wartime Report No. L-665)*, May, 1944. 48 pp., diagrs. 31 references.

Two-Dimensional Wind-Tunnel Investigation of a 10.7-Percent-Thick Symmetrical Tail Section with a 0.40 Airfoil-Chord Control Surface and a 0.20 Control-Surface-Chord Tab. Albert L. Braslow. *U.S., N.A.C.A., Technical Note No. 1228*, June, 1947. 38 pp., illus. 3 references.

Sealing the tab nose gap generally increased the flap lift effectiveness and the tab-hinge-moment effectiveness. Sealing the flap gap increased the rate of change of section lift coefficient, negatively increased the rate of change of flap section hinge-moment coefficient, eliminated sharp irregularities in the variation of both section angle of attack and flap deflection, and greatly reduced all but the minimum values of section drag coefficient at all flap deflections tested.

Wind-Tunnel Investigation of a Plain Aileron and a Balanced Aileron on a Tapered Wing with Full-Span Duplex Flaps. F. M. Rogallo and John G. Lowry. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-481)*, July, 1942. 33 pp., diagrs. 5 references.

The Aerodynamics of Aircraft Radar Antennas. Lange. (*Deutsche Versuchsanstalt für Luftfahrt, ZWB/UM/1238*, April, 1944.) *U.S., Army Air Forces, Translation No. F-TS-1104-RE*, June, 1947. 45 pp., illus. 6 references.

The Bending of the Cable of a Kite Balloon Under the Action of the Wind (Ob Izgibe Trosa Zmeikovogo Aerostata pod Deistviem Vetra). N. E. Kochin. *Prikladnaia Matematika i Mekhanika* (Moscow), Vol. 10, No. 1, 1946, pp. 153–164, figs. 3 references. (In Russian.)

Flight Investigation of NACA DS Cowlings on the XP-42 Airplane. I—High-Inlet-Velocity Cowling with Propeller Cuffs Tested in High-Speed Level Flight. F. J. Bailey, Jr., and J. Ford Johnston. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-383)*, January, 1943. 49 pp., illus. 4 references.

The One-Dimensional Theory of Steady Compressible Fluid Flow in Ducts with Friction and Heat Addition. Bruce L. Hicks, Donald J. Montgomery, and Robert H. Wasserman. *U.S., N.A.C.A., Technical Note No. 1336*, July, 1947. 26 pp., figs. 19 references.

A simplification of the solution in the three-dimensional case of the differential equations describing diabatic, frictional, variable-area compressible fluid flow. The one-dimensional or hydraulic treatment is generalized to include the simultaneous effects of heat addition, friction, and area change. Generalized conservation equations have been derived, and the resulting theory is intended to serve as a foundation in differential form for calculations of all types of mathematically continuous flow of perfect gases to which the one-dimensional approximation is applicable. In order to obtain convenient and unified equations, the generalized relations are transformed by introducing a new basic variable, the square of the local Mach Number. Pressure and temperature are chosen as the additional basic variables. In the general case the differential equations obtained do not permit of formal integration, but, since they are of the first order, they are particularly amenable to numerical methods. A solution of the system is shown to exist, except possibly at sonic velocity.

Rigorous Solution of Linearized Supersonic Flow Through Ducts. C. E. Mack, Jr., H. F. Ludloff, and F. Reiche. *Journal of Applied Physics*, Vol. 18, No. 7, July, 1947, pp. 682, 683.

In the case of constant source strength along a skeleton cylinder a solution may be obtained in closed form. Complete elliptic integrals of the third kind that arise may be expressed in terms of elliptic integrals of the first and second kinds so that existing tables suffice for numerical computation. The solution assumed different forms depending on the location of the test point. If the test point is so located that its fore cone cuts some, but not all, of the generatrices of the skeleton cylinder, it is said to lie in the front district. If the fore cone of the test point cuts all the generatrices of the skeleton cylinder, it is said to lie in the rear district. The solution for each region is developed separately.

Linearized Supersonic Flow through Ducts. H. F. Ludloff and F. Reiche. *Journal of Applied Physics*, Vol. 18, No. 7, July, 1947, pp. 681, 682.

An approximate, analytic method of computing the supersonic field of flow through ducts. Employing the linearized theory of supersonic flow, supersonic sources of various intensities are spread over the surface of a hollow skeleton cylinder. Solutions are obtained which express the essential flow features in relation to the shape of the nozzle wall.

General Characteristics of the Flow Through Nozzles at Near Critical Speeds. R. Sauer. (*Deutsche Luftfahrtforschung, Forschungsbericht, ZWB/FB/1992.*) *U.S., N.A.C.A., Technical Memorandum No. 1147*, June, 1947. 20 pp., figs. 5 references.

Approximation formulas are developed for the position and the curvature of the critical curve for the transition through the critical velocity at the narrowest cross section of flat and round Laval nozzles. These formulas give results that agree satisfactorily with the nozzle flows calculated by Kl. Oswatitsch and W. Rothstein. Corresponding approximation formulas are deduced for profile flow with local supersonic regions.

Elbows for Accelerated Flow. G. F. Carrier. *Journal of Applied Mechanics*, Vol. 14, No. 2, June, 1947, pp. A-108–A-112, figs., tables.

The criteria are suggested which must be satisfied by a two-dimensional channel and elbow that will most effectively turn a stream of nonviscous, incompressible fluid through a given angle with a given velocity increment. The solution of this problem is developed further, using the von Kármán-Tsien linearized pressure-volume relation for a compressible medium.

A Mathematical Method of Cascade Design. M. J. Lighthill. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2104*, June, 1945. 16 pp., figs.

By means of the conformal transformation of a cascade of airfoils into a circle, the method given enables the shape of the airfoils to be determined from any preassigned distribution of velocity (which satisfies certain conditions) given on the circle. An example is worked out to show how the method is carried out in practice. Two workers, at least one of whom possesses a thorough knowledge of the complex variable and of Cauchy's theorem, should do the calculations, checking one another.

Pressure Distribution Measurements in a Turbine Rotor Blade Passing Behind a Turbine Nozzle Lattice. Hausenblas. (*Luftfahrtforschungsanstalt Hermann Göring, Institut für Motorenforschung, Berichte der Gittertagung in Braunschweig*, March 27, 28, 1944, Br. B. *Nr. M325/44g*, pp. 95–100.) *U.S., N.A.C.A., Technical Memorandum No. 1173*, July, 1947. 6 pp., diagrs.

A quantitative investigation of the periodic fluctuation of the pressure distribution around the circumference of turbine rotor blades which is caused by the wake zones of the nozzle vanes. The periodic fluctuation of the rotational force cannot be omitted from consideration as a cause of vibration in the blades, since the amplitude of the first harmonic amounts to about 24 per cent of the mean value of the peripheral force. Circulation changes require a certain length of time for development; hence, these re-

sults, which were obtained at low velocities, cannot be transferred to actual high-speed turbine operations.

Internal Aerodynamics Opens New Speed Fields. *Aviation Week*, Vol. 47, No. 2, July 14, 1947, pp. 25, 26, illus. 19 references.

A summary of the characteristics of subsonic and supersonic internal flow and their influence on the design of air intakes and external scoops and on ducting losses. Internal air handling is a considerable factor in jet-engine efficiency, and the solution of the problem of handling internal supersonic flow is expected to make possible the development of a supersonic ram-jet engine that could compete economically with the reciprocating engine.

Three-Component Force and Mass-Flow Measurements on a Jet Nacelle. G. Ilgemann and E. Moller. (*Braunschweig, Technische Hochschule, Aerodynamisches Institut, Bericht Nr. 45/3*, March 8, 1945.) *U.S., N.A.C.A., Technical Memorandum No. 1149*, June, 1947. 30 pp., figs. 5 references.

Force and mass-flow measurements were carried out on a jet nacelle with an inlet-exit velocity ratio greater than zero and less than 0.76. The three-component force measurements show an increase in the slope of the lift curve and a decrease in the unstable moment with mass flow. The neutral point of the friction lift travels forward with increasing mass flow. The mass-flow measurements show that, up to an angle of attack of 12°, an even velocity distribution is to be found in the annular cross section of the nacelle. The flow displacement that appeared at 18° does not affect the mass flow.

D-C Network-Analyzer Determination of Fluid-Flow Pattern in a Centrifugal Impeller. C. Concordia and G. K. Carter. *Journal of Applied Mechanics*, Vol. 14, No. 2, June, 1947, pp. A-113–A-118, figs. 3 references.

An electrical method of determining the flow pattern for the flow of an incompressible ideal fluid through a two-dimensional centrifugal impeller. The method can be applied to impellers with blade of arbitrary shape, as distinguished from analytical methods that can be applied directly only to blades of special shape.

Laboratory Report on the Investigation of the Flow Around Two Turbine-Blade Profiles Using the Interferometer Method. K. von Vietinghoff-Scheel. (*Luftfahrtforschungsanstalt Hermann Göring, Braunschweig, Institut für Motorenforschung, ZWB/UM/2096*, May 31, 1944.) *U.S., N.A.C.A., Technical Memorandum No. 1171*, July, 1947. 16 pp., illus. 1 reference.

Heat-Transfer Coefficients for Air Flowing in Round Tubes, in Rectangular Ducts and Around Finned Cylinders. Roger E. Drexel and William H. McAdams. *U.S., N.A.C.A., Advance Restricted Report No. 4F28* (*Wartime Report No. W-108*), February, 1945. 52 pp., diagrs. 38 references.

Air Transport

Selecting a Feeder Fleet. H. K. Gilbert. *Air Transport*, Vol. 5, No. 7, July, 1947, pp. 44, 45, table.

A cost comparison of possible feeder transports. The initial, direct, and indirect costs and the operational characteristics are tabulated for the Martin 2-0-2, the Northrop Pioneer, the Douglas DC-3, the Boeing 417-40, the Beech 34, the Douglas Skybus, and the Lockheed Saturn.

IATA Bulletin, June, 1947. *Montreal, International Air Transport Association.* 28 pp., map.

The minutes of the Eighth Meeting of the Executive Committee of the International Air Transport Association; a map of the traffic conference areas defined by the Executive Committee, the provisions of I.A.T.A. for conduct of traffic conferences, and a review of the first assembly of I.C.A.O.

Air Transport for the Masses. B. E. Cole. *Air Transport*, Vol. 5, No. 7, July, 1947, pp. 46–49, 75, illus.

Atlantic Airlines proposes a short-haul passenger transport rate of $00.035 per mile. Hauls of from 100 to 300 miles with a contracting bus service at each airport covering another 50-mile radius would offer substantial timesaving over surface transportation. Reduction in nonflying time would be accomplished by elimination of baggage and passenger checking prior to boarding the airplane. Tickets and cash fares would be collected en route.

Brooklyn Survey Shows Air Travelers Repeat. Otto M. Ehrlich. *Air Transport*, Vol. 5, No. 7, July, 1947, pp. 34, 35, illus.

A statistical analysis of 2,728 questionnaires sent out by *The Brooklyn Eagle* and answered by residents of Brooklyn, N.Y. The percentages of those who do and who do not contemplate traveling by air in the future are tabulated according to income group, occupation, and whether or not they have previously used air transportation.

The Four-Engine Pilot Pay Case. I. Edwin M. Fitch. *Air Transport*, Vol. 5, No. 7, July, 1947, pp. 37–39, illus.

An historical survey of the wage disputes between the Air Line Pilots Association and the air-line operators.

Civil Aviation in France. *Shell Aviation News* (London), No. 108, June, 1947, pp. 8–10, illus.

Airplane Descriptions

AAF Generals Hail B-50 as New Standard Bomber. *Aviation Week*, Vol. 47, No. 2, July 14, 1947, p. 13, illus.

The four-engined Boeing B-50 has a top speed of 425 m.p.h. and a cruising speed of better than 300 m.p.h. Developing 59 per cent more power than the B-29, the B-50 can carry an external bomb load of 20,000 lbs. for short ranges. The range without bombs is 7,000 miles. Modified for photoreconnaissance, the B-50 has a range of 10,000 miles.

McDonnell "Banshee" XF2D-1. *Aero Digest*, Vol. 55, No. 1, July, 1947, pp. 71, 124, illus.

The XF2D-1 Navy carrier-based, twin-engined fighter is heavier and faster than the FD-1 Phantom but similar in appearance. Two Westinghouse Yankee 24C axial-flow turbojet engines develop the equivalent of 11,000 hp. and give a speed of about 600 m.p.h.

Better Air and Ground Handling Attained in North American XFJ-1. *Aviation Week*, Vol. 47, No. 1, July 7, 1947, p. 35, illus. (Cf. AER 3/47:47.)

North American's Navy jet fighter has wing-tip fuel tanks that, when jettisoned, receive a lateral displacement putting them outside the flight path. Fixed control surfaces on the tank stabilize its separation from the wing tips and prevent the rear of the tank from whipping inward and striking an aileron. Perforated dive brakes prevent the formation of large vortices that would cause tail buffeting. Kneeling nose gear provides easier ground-handling characteristics.

Beech Releases Details and Photos of Feederliner. *Aviation Week*, Vol. 47, No., July 7, 1947, p. 26, illus.

The Beech model 34 transport will be a high-wing monoplane with a modified V-tail configuration. Four 326-hp. flat eight-cylinder Lycoming S-580 engines buried spanwise in the wings will drive two propellers. Maximum seating capacity is to be 20 passengers. Stowable seats will permit relocation of the cargo bulkhead and variation of cargo compartment size.

Solely for Research. *Flight*, Vol. 51, No. 2007, June 17, 1947, p. 554.

The French Aerocentre N.C. 3021 Belphegor is powered by a German Daimler-Benz DB 610 engine, which consists of two DB 605 engines mounted side by side and driving a single propeller. It will be capable of a maximum speed of 348 m.p.h. The fuselage is of semimonocoque mixed wood and metal construction. The Belphegor will be used for research in aerodynamics, meteorology, and cosmic rays.

Baumann Brigadier Makes First Flight. *Aviation Week*, Vol 47, No. 2, July 14, 1947, p. 39. The Baumann Brigadier is designed for personal or light transport use. Its twin Continental engines develop 250 hp. Cruising speed is 150 m.p.h.

Westland Wyvern. *Flight*, Vol. 52, No. 2010, July 3, 1947, p. 5, illus.

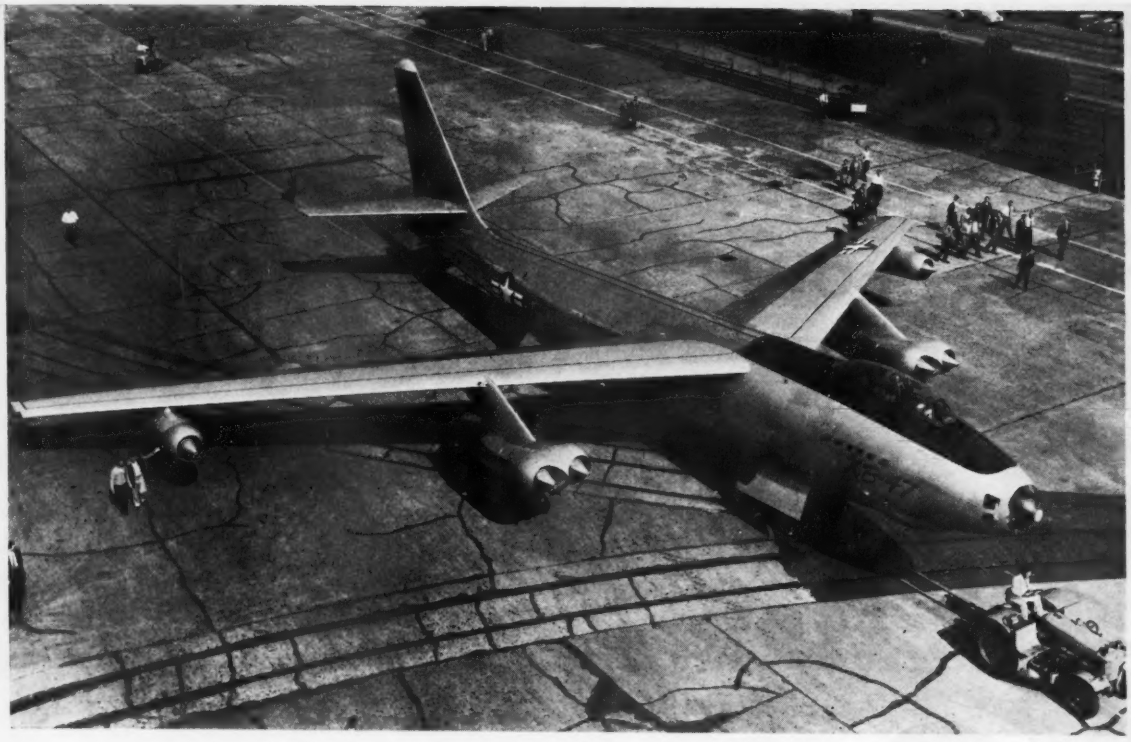
The all-metal single-place Westland Wyvern T.F. 1 is designed as a deck-landing naval strike fighter. It is powered by a Rolls-Royce Eagle 24-cylinder engine driving an eight-bladed counter-rotating Rotol propeller.

New Avro Trainer. *Aircraft and Airport*, Vol. 9, No. 6, June, 1947, p. 24, illus.

The Athena, manufactured by A. V. Roe and Co., Ltd., is powered by a 1,000-hp. gas-turbine propeller engine and features exceptionally good visibility and side-by-side seating in the cockpit. Three new Ansons, Marks XX, XXI, and XXII, have also been developed for specialized training.

New Types in the Air. XII—The de Havilland Sea Vampire XX and the SAAB J21R. *The Aeroplane Spotter*, Vol. 8, No. 190, June 28, 1947, p. 137, illus.

The de Havilland D.H. 100 Sea Vampire F. Mk XX is a British jet-propelled, carrier-based fighter. It is an adaptation of the R.A.F. fighter and differs principally in having a deck arrestor hook. The Svenska Aeroplan A.B. single-seater fighter J 21R, a



The new experimental Boeing XB-47 Stratojet features a new design philosophy in large aircraft. The ultra-thin sweptback wings support six General Electric jet engines in double nacelles inboard and singly near the wing tips. The new bomber has a wing span of approximately 116 ft. and an overall length of 108 ft.

modification of the J 21, is equipped with a de Havilland Goblin II gas turbine providing 3,000 lbs. static thrust to give a maximum speed of about 500 m.p.h.

German Aircraft in Detail. XIII—The Blohm und Voss Bv 155c. *The Aeroplane Spotter*, Vol. 8, No. 189, June 14, 1947, p. 124, illus.

Description of a high-altitude fighter developed from the Me 109, designated the Me 155 until development was taken over by Blohm & Voss. The Bv 155c had an air frame of composite construction, had a pressurized cabin, and was powered by a Daimler-Benz DB 603u. Development was not completed.

Italians Start Work on Two New Transports. *Aviation Week*, Vol. 47, No. 1, July 7, 1947, p. 44, illus.

Description of the SM-102 and the BZ-309. Both are twin-engined feeder-type passenger transports.

Continental Light Transports: The Zlin 20 and the Fiat G.26. *The Aeroplane*, Vol. 78, No. 1882, p. 19, illus. The Czechoslovakian Zlin 20 and the Italian Fiat G.26 are both two-engined low-wing cantilever monoplanes, designed as commercial passenger or freight transports.

The Aerocar Major Flies. *The Aeroplane*, Vol. 78, No. 1882, pp. 5, 19, cutaway diagr.

The prototype Aerocar Major is a twin-engined twin-boom high-wing monoplane. It is powered by two Cirrus Major series III 155-hp. engines driving fixed-pitch two-bladed propellers.

Flying the Arrow. D. A. S. McKay. *Aeronautics*, Vol. 16, No. 6, July, 1947, pp. 52, illus.

Comments on the performance of the Auster J/2 Arrow. The Arrow is a light airplane of composite construction and is powered by a 75-hp. Continental C-75-12 four-cylinder engine.

Automobilove Zavody M.1C Sokol. *The Aeroplane Spotter*, Vol. 8, No. 190, June 28, 1947, p. 141, illus.

The Czechoslavakian M.1C Sokol three-place sports-trainer is built of wood with light plywood and fabric covering. The tail wheel is fixed and the semiretractable undercarriage is manually operated. The Walter Minor 4-III air-cooled four-cylinder engine develops 105 hp. Cruising speed is 134 m.p.h.

Monowheel Gear in Volmer VJ-21. *Aviation Week*, Vol. 47, No. 2, July 14, 1947, p. 36, illus. (Cf. AER 3/47:47.)

Northrop Pioneer. *Shell Aviation News* (London), No. 108, pp. 20, 21, illus. (Cf. AER 1/47:39.)

Canadair Four: Rolls-Royce Engined DC-4M Stepped Up in Weight and Accommodation: Impressions in the Air. *Flight*, Vol. 51, No. 2009, June 26, 1947, pp. 609, 610, illus. (Cf. AER 3/47:47.)

New Canadair Four Is Hybrid DC-4, DC-6. *Aviation Week*, Vol. 47, No. 1, July 7, 1947, p. 22. (Cf. AER 3/47:47.)

The Lockheed Constitution. *The Aeroplane*, Vol. 72, No. 1880, June 20, 1947, pp. 652, 653, illus.

The New Constellation. *The Aeroplane*, Vol. 78, No. 1882, July 4, 1947, pp. 16, 17, illus.

Airplane Design

The Development of All-Wing Aircraft. John K. Northrop. (35th Wilbur Wright Memorial Lecture.) *Royal Aeronautical Society, Journal*, Vol. 51, No. 438, June, 1947, pp. 481–510, figs. (Cf. AER 9/47:31.)

All-Wing Aircraft. I, II. J. K. Northrop. *Flight*, Vol. 51, Nos. 2006, 2007, June 5, 17, 1947, pp. 528–531; 548–551, illus. (Extended abstract of a paper.) (Cf. AER 9/47:41.)

Jet Pilot Safety. *Naval Aviation News* (*Naval Air Reserve Edition*), No. 2, June, 1947, pp. 17–19, illus.

The escape of pilots from high-speed aircraft requires the use of ejection seats or jettisonable cockpits. This type of cockpit is discussed with respect to the aerodynamic shape it would require. A similar problem of high-speed flight is the design of a parachute that will open without subjecting the personnel or instruments to too severe a shock but which will provide sufficient resistance to prevent too rapid a descent.

Tomorrow's Cargo Needs. J. E. Winchester. *SAE Journal*, Vol. 55, No. 7, July, 1947, pp. 46–48, fig. (Extended abstract of a paper: Suggested Design and Operating Requirements for Cargo Transports.) (Cf. AER 5/47:35.)

Birth of the Beech Bonanza. *SAE Journal*, Vol. 55, No. 7, July, 1947, pp. 36–39, illus. (Extended abstract of a paper: Development of the Beech Bonanza Light Four-Place High Performance Airplane.)

Mr. W. W. Davies' position as Director of Engineering for United Air Lines causes him to look at aircraft with a practical eye.

"When United buys a new type, of course we check design, construction and all the rest.

"But we go even farther. We ask, 'How much money can this airplane earn for us? How does payload compare with operating cost?' You see, with us, it's a matter of dollar and cents.

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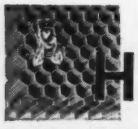

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Lightplanes to Benefit from New Data. *Aviation Week*, Vol. 47, No. 3, July 21, 1947, pp. 26, 27, illus. 19 references.

A survey of research conducted by the N.A.C.A. which is applicable to the development of light aircraft.

NACA Reveals New Results of Supersonic Research Program. Robert Hotz. *Aviation Week*, Vol. 47, No. 1, July 7, 1947, pp. 18, 21, illus.

Airways and Traffic Control

Air Track Flight Control for New York. A. E. Blomquist. *Air Transport*, Vol. 5, No. 7, July, 1947, pp. 40–43, diagrs.

A description of the flight control system proposed by the author to the Port of New York Authority in "Analysis of Air Track Control System." The General Railroad Signal Company's traffic control system provides indication to the pilot as he enters the control blocks. The pilot indicates his preference in approach paths which is confirmed or denied by the dispatcher.

Bibliography

List of the Scientific Works, Translations, Papers, Reviews, and Articles of A. N. Krylova (Spisok Nauchnykh Trudov, Perevodov, Referatov, Retsenzii i Statei A. N. Krylov). *Prikladnaia Matematika i Mekhanika* (Moscow), Vol. 10, No. 1, 1946, pp. 8–20. (In Russian.)

A chronological list of over 300 publications mostly pertaining to the motion and vibration of ships but including many references on the trajectories of projectiles, gyroscopic theory, the magnetic compass, and structures.

Comfort in Aircraft

Acoustical Materials and Acoustical Treatments for Aircraft. R. H. Nichols, H. P. Sleeper, and others. *Acoustical Society of America, Journal*, Vol. 19, No. 3, May, 1947, pp. 428–443, diagrs. 8 references.

Soundproofing treatments for aircraft must be designed to provide high degrees both of attenuation of sound transmitted through the fuselage and of absorption of sound within the cabin. Impervious and absorptive structures, both single and multiple, are examined to determine their attenuation and absorption characteristics. These properties are used as factors that determine the selection and application of acoustical materials and the effect of aircraft constructional details on the acoustical properties of aircraft cabins.

Control Systems

Automatic Control of Airplanes with Special Regard to Yaw. M. Schuler and R. Fuchs. (*ZWB/FB/1353.*) *Cornell Aeronautical Laboratory*, June, 1947. 42 pp., diagrs.

The motion of an automatically controlled, high-speed airplane is calculated. The position angle is determined and from it a direct solution for the flight-path angle is obtained. The uncontrolled airplane is first considered in order to determine the requirements of automatic control. All differential equations are linearized and the flight velocity is assumed to be constant. Model laws are developed for test tables. The control of the automatic pilot is applied to these tables, which, when these laws are fulfilled, will reproduce the oscillations of the controlled aircraft. Limits of sure and stable control can be determined by varying the constants of the table. The constants of the airplane which limit the range of stability can be measured in the wind tunnel. A comparison of these constants with those displayed by the test table under control make it possible to determine from laboratory tests whether a particular automatic control system is suitable for a given airplane.

Control Linkage Bearing. *Flight*, Vol. 51, No. 2008, p. 585, illus.

A bearing, designed by Thomas L. Marshall, for standard control transmission linkage torque or push-pull tubes consists of four quadrantally disposed spring-loaded Oilite nodules housed in an annular carrier. The bearing is nonjamming and unseizable, and its low-friction contact makes lubrication unnecessary.

Automatic Regulators and Servo Mechanisms. I. *Engineering*, Vol. 103, No. 4246, June 13, 1947, p. 494.

Abstracts of six of the 15 papers read before the Institution of Electrical Engineers. The papers dealt with the fundamental principles of automatic regulating and servomechanisms, their use by the Army and Navy, the elements of velocity and acceleration control of a body, the operator's response in manual control, and the history of data-transmission systems.

Automatic Regulators and Servo-Mechanisms; Summaries of Papers Presented at Institution of Electrical Engineers Convention in London, England, May 19–22, 1947. *Instruments*, Vol. 20, No. 7, July, 1947, pp. 643–645.

Hydraulic Variable-Speed Transmissions as Servometers. George C. Newton, Jr. *The Franklin Institute, Journal*, Vol. 243, No. 6, June, 1947, pp. 439–469, diagrs. 4 references.

An analysis of hydraulic transmission. A comparison is made between the predicted behavior based on the analysis and the behavior observed in frequency response tests for three servomechanisms. Discrepancies between predicted and measured performance are discussed, and suggestions are made for improvement of transmission performance.

Engine Parts and Accessories

Tests to Determine the Effect of Heat on the Pressure Drop Through Radiator Tubes. Louis W. Habel and James J. Gallagher. *U.S., N.A.C.A., Technical Note No. 1362*, July, 1947. 24 pp., diagrs. 4 references.

At usual radiator operating temperatures and Mach Numbers, the addition of heat produced large increases in the pressure drops required to induce a given flow of cooling air through the radiator tubes. These increments were in good agreement with theoretical calculations of the heating effect. For very high tube temperatures corresponding to high rates of heat input the experimental pressure-drop increments for tubes of large length ratios exceeded the theoretical values by an appreciable amount in the vicinity of the choking Mach Numbers. The experimental choking Mach Numbers, however, agreed with the values predicted by theory for all tubes tested.

German Types of Heaters and Coolers for Marine and Land Application. H. E. Upton, A. M. Martin, and H. K. Winterberg. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 540.* 196 pp., illus. British Information Services, New York. $4.50.

Reports of inspections made at ten targets. Among the targets were included: Rudolph Otto Meyer, Hamburg, manufacturer of air conditioners and fans, air preheaters, and oil coolers; Brown Boveri & Cie. A.G., Mannheim, designers and manufacturers of secondary-surface heat exchangers and coolers; Suddeutscher Kuhlerfabrik Julius Fr. Behr., Stuttgart-Feuerbach, producing an all-aluminum aircraft oil cooler that incorporates Behr flattened rolled finned tubes; and M. A. N., Augsburg, which has done extensive research on heat exchangers for gas turbines and air coolers for diesel engines. The original documents that were submitted with the field reports are reproduced.

Wright "Cylinjector" System. *Shell Aviation News* (London), No. 108, June, 1947, p. 24, illus.

A metering fuel-injection system designed by Wright Aeronautical Corporation and manufactured by Bendix Aviation Corporation. A nine-cylinder pump supplies fuel through individual lines to nine engine cylinders. Fuel is metered to the pump by a master control in accordance with the mass airflow in the induction passage. The system has fuel consumption as much as 5 per cent and acts as a priming system for cold-weather starting.

Unusual Bristol Gearing. *Automotive Industries*, Vol. 97, No. 1, July 1, 1947, p. 44, diagr.

A cutaway drawing and description of the propeller drive and reduction gearing used on the power plant for the Bristol 167. The coaxial counterrotating propellers are driven by separate engines horizontally placed with their crankshafts at an angle of 64°.

Engines—General

Evaluation of Power Units According to Flight Velocity, Altitude and Range in the Space Diagram. Heinrich Reindorf. (*ZWB/LFM/3*, August–October, 1945.) *U.S., Army Air Forces, Translation No. F-TS-3211-RE*, June, 1947. 297 pp., figs.

Fuel economy calculated as the ratio of the load distance to the weight of the fuel and lubricants consumed was taken as an index of power-plant efficiency. This efficiency at various altitudes was calculated for the Diesel engine, the propeller-turbine-jet, the turbine-jet, and the Lorin power-plant systems, all in constant altitude flight. The results are plotted on a separate sheet for each altitude. If these sheets are arranged one over another at equal intervals, a space diagram is obtained with axes for mean flight velocity, range, and flight altitude. Such numerical data as were necessary were selected to give an operable power plant. In view of the qualitative nature of the work the same polar curve is applied to all flights for purposes of simplification. An analysis of the diagram shows the predominant importance of the Diesel and the jet-turbine systems up to about 18 km. At 20 km. the Lorin system assumes dominance and retains it to about 30 km., at which altitude it ceases to function. It can also be seen from the diagram that the propeller-turbine-jet system is dominant in no region.

Fedden Power Units. *Flight*, Vol. 51, No. 2009, June 26, 1947, 600a, 600b, 601, 602, illus.

Design details of the Cotswold turboprop and the Fedden flat-six light aircraft engine. The turboprop, which is illustrated by a cutaway diagram showing the principal components, employs a fabricated disc-type compressor rotor, two-stage epicyclic reduction gearing, divergent flame chambers, and a fairing disc between two-stage turbine discs. The 5.3-liter Fedden flat-six engine is designed to be completely submerged in the aircraft wing. The cooling air that is inducted at the leading edge of the wing is divided, one portion passing over the crankcase and the other being led to the individual cylinder heads.

Engines, Gas Turbine

Gasdynamic Aspects of Combustion in Jet Propulsion. D. G. Samaras. *National Research Council, Ottawa, Canada.* (For abstract see "I.A.S. Briefs" on page 24 of this issue, October, 1947.)

Problems in the Mechanical Design of Gas Turbines. Ronald B. Smith. *Journal of Applied Mechanics*, Vol. 14, No. 2, June, 1947, pp. A-99–A-102, figs.

The high temperatures involved in the operation of the gas turbine have made it necessary to abandon the theory of elasticity as the sole design basis. The theory of plasticity applied in the maximum-stress theory of rupture can serve as a guide to the properties of metals under stress at elevated temperatures for prolonged periods. The present development of the theory is inadequate, and research remains to be done on fatigue failure and bolting materials under the conditions encompassed by the theory of plasticity.

Effect of Combustion-Inlet Conditions on Performance of an Annular Turbojet Combustor. J. Howard Childs, Richard J. McCafferty, and Oakley W. Surine. *U.S., N.A.C.A., Technical Note No. 1357*, July, 1947. 52 pp., illus.

The combustor that was tested operated at efficiencies above 90 per cent and could produce a temperature rise far in excess of the engine requirements when the simulated altitude was 8,000 ft. or more below the operational limits. As the simulated altitude was progressively increased the obtainable combustion temperature and temperature rise both decreased. Above operational limits, the maximum obtainable temperature rise was below the value required for engine operation. The existence of altitude operational limits are explained in terms of the effects of combustor-inlet conditions on performance.

Gas Turbine Combustion. E. A. Watson and J. S. Clarke. *Flight*, Vol. 51, No. 2007, June 17, 1947, pp. 555–557, diagrs. (Extended abstract of a paper: Combustion and Combustion Equipment for Aero Gas Turbines.)

Heat release of fuel-burning engines in general is compared with the gas-turbine liquid-fuel burners, and their relative efficiency is determined. The design of the combustion chamber and the methods of injecting and atomizing the fuel as factors determining airflow patterns and turbulence are discussed with reference to engine efficiency.

Improvements in Turbojet Installations. R. E. Small. *SAE Journal*, Vol. 55, No. 7, July, 1947, pp. 57–60, illus. (Extended abstract of a paper: Installation Engineering of Aircraft Turbojet Engines.) (Cf. AER 5/47:41.)

The latest development in English design is this Saunders-Roe SR/A1 jet-propelled fighter flying boat. Two Metropolitan-Vickers Metrovick F.2/4 jet engines deliver 3,500 lbs. of thrust at take-off.

Performance of Compressor Turbine Jet-Propulsion Systems. Carl B. Palmer. *U.S., N.A.C.A., Advance Confidential Report No. L5E17 (Wartime Report No. L-278)*, June, 1945. 34 pp., figs. 3 references.

Composite Engine Fuel Costs. John F. Fairlie. *Aero Digest*, Vol. 55, No. 1, July, 1947, pp. 44, 45, illus.

A comparison of the fuel costs of a reciprocating aircraft engine and a propeller-turbine engine. An analysis of present factors and future prospects indicates that the present cost differential in favor of the turbine engine will probably remain unchanged. Tables are given for fuel consumption per horsepower and fuel costs at various speeds.

Preliminary Report on the Fundamentals of the Control of Turbine-Propeller Jet Power Plants. H. Kühl. (*Deutsche Versuchsanstalt für Luftfahrt, ZWB/UM/1272*, June 9, 1944.) *U.S., N.A.C.A., Technical Memorandum No. 1172*, July, 1947. 36 pp., diagrs. 4 references.

A mathematical investigation of the optimum division of power between the jet flow and the propeller of a propeller-turbine-jet power plant. The variations in efficiency of the propeller indicate that under certain conditions a variation of the jet-nozzle flow area would be advantageous. An example is given of a control system that could be applied to a power plant of this type.

Aircraft Turbojet and Gas-Turbine Engine Starter Systems. A. G. Bardwell. *Mechanical Engineering*, Vol. 69, No. 7, July, 1947, pp. 577–580, figs.

The high power required of starter systems to give adequate initial speed of rotation to gas-turbine and turbojet engines has placed the starting problem beyond just an increase in size of the motor and capacity of the batteries. The internal-combustion reciprocating starter engine, the solid propellant turbine starters, and the ground-powered starter system can be temporary solutions. Auxiliary power units with hydraulic drive and turboalternators operating on a bleed from the compressor offer possibilities for future development.

Flexible Mounting for Turbines. Vincent Ellis and William A. Keech. *Aero Digest*, Vol. 55, No. 1, July, 1947, pp. 58, 59, 114, illus.

The mountings of aircraft turbine engines must accommodate distortion of the air frame, thermal expansion of the engine components, and vibrations that may result from unbalance between the rotor and the propeller. They must also isolate vibrations in order to prolong the life of the surrounding structure. Bonded rubber mounts so placed as to bring the combined elastic center as nearly as possible into coincidence with the center of gravity of the mounted unit can be used for this purpose.

Investigation of the B.M.W. 003 Turbine and Compressor Blading. André Planiol. *U.S., Field Information Agency, Technical, Final Report No. 441*, October 31, 1945. 9 pp., diagrs. British Information Services, New York. $0.35. An outline of the factors that determined the design of the turbine buckets and nozzles and the blades of the compressor.

Wright Gas-Turbine Laboratory. *Aero Digest*, Vol. 55, No. 1, July, 1947, p. 65, illus.

The gas-turbine aircraft-engine development laboratory of the Wright Aeronautical Corporation is operating for the Army Air Forces is designed to permit the testing of major engine co

ponents without operating the complete engine. Test equipment is capable of absorbing and measuring 20,000 hp.

"Lincoln II" Bomber with Propeller Turbine Engines. *The Engineer*, Vol. 183, No. 1856, June 13, 1947, pp. 515–517, illus.

A description of a test flight in which two Bristol "Theseus" propeller-turbine engines were substituted for the two outboard reciprocating power plants of the four-engined heavy bomber.

The de Havilland "Ghost" Jet-Propulsion Engine. *Engineering*, Vol. 163, No. 4247, June 20, 1947, pp. 520, 521, illus. (Cf. AER 9/47:49.)

Metrovick Progress: Type Test Completed for the F.2 Series 4 Gas Turbine. *Flight*, Vol. 51, No. 2007, June 17, 1947, p. 552. (Cf. AER 4/47:44.)

Design Analysis of the General Electric TG-180 Turbojet. I. Neil Burgess. *Aviation Week*, Vol. 47, No. 1, July 7, 1947, pp. 36, 39, 41–43, illus. (Cf. AER 7/47:45.)

Design Analysis: General Electric TG-180 Turbojet. II. Neil Burgess. *Aviation Week*, Vol. 47, No. 2, July 14, 1947, pp. 29, 30, 33, illus. (Cf. AER 7/47:45.)

A description of the accessories and drives, lubrication, fuel, ignition and starter systems, the engine mounting, and the pilot's controls. Schematic diagrams of the lubrication system, the electrical system, and the fuel system with its hydraulic oil line are included.

Rolls-Royce "Nene." *Shell Aviation News* (London), No. 108, June, 1947, pp. 22, 23, illus. (Cf. AER 5/47:41.)

Engines, Ram-Jet

Momentum Relations in Propulsive Ducts. Philip Rudnick. *Journal of the Aeronautical Sciences*, Vol. 14, No. 9, September, 1947, pp. 540–544, figs. 1 reference.

The importance of momentum relations in all forms of jet propulsion has led to the development of a working concept, called the "stream thrust," which is considered as a function of position along a steady "unidimensional" compressible flow through a duct. This function is a quantity equal to the cross-sectional area multiplied by the sum of the pressure and of the density times the flow velocity squared. The function has the fundamental property that the difference between its values at any two sections of a stream gives the resultant of all normal and tangential forces acting on the duct walls between those sections. Its use is illustrated for determining the Mach Numbers ahead of, and behind, a normal shock; for calculating the thrust against the expanding section of an exit nozzle as a criterion of quality of combustor performance; and for the calculation of the design of a ram-jet engine.

Walter Werke, Kiel. C. L. Barham and R. Simard. *Combined Intelligence Objectives Subcommittee, Item No. 5, File No. 28-53.* 15 pp., diagrs. British Information Services, New York. $0.55.

A summary of the research conducted on athodyds. An experimental model 840 mm. in length was under construction and was intended as a propulsive unit for a Ju 263. The report describes the various rocket-Lorin engines, investigated to provide the athodyd with take-off power, and the work that was done on intermittent jet action.

Engines, Reciprocating

Effect of Exhaust Pressure on the Performance of a 12-Cylinder Liquid-Cooled Engine. Leland G. Desmon and Ronald B. Doyle. *U.S., N.A.C.A., Technical Note No. 1367*, July, 1947. 50 pp., illus. 5 references.

Tests were conducted on a dynamometer-stand to show the effect of exhaust pressure on engine power, charge-air flow, volumetric efficiency, inlet-manifold mixture temperature, exhaust gas temperature, cylinder-head temperature, and heat transferred to the coolant. The results are given in the form of generalized curves.

Foresee Wider Use of Exhaust Jet Cooling. *Automotive Industries*, Vol. 97, No. 2, July 15, 1947, pp. 34, 35, 74, 76, 80, 82, diagrs.

An exhaust-jet cooling system utilizes the energy in the exhaust gases to induce a flow of cooling air across the engine. Since this system is independent of the ram pressure built up by the forward air speed of the airplane, inlets may incorporate the best aerodynamic design. As a further result, the location of the engine in the air frame is not limited by the requirements of conventional cooling-system design.

Correlation of Engine-Cooling Data. D. E. Brimly and Maurice J. Brevoort. *U.S., N.A.C.A., Memorandum Report No. L5A17 (Wartime Report No. L-685)*, January, 1945. 26 pp., figs. 7 references.

Cowling and Cooling Tests of a Fleetwings Model 33 Airplane in Flight. Herman H. Ellerbrock and Herbert A. Wilson, Jr. *U.S., N.A.C.A., Memorandum Report (Wartime Report No. L-632)*, May, 1944. 61 pp., illus. 6 references.

Helicopter Designers Weed out Engine Installation Foibles. Robert A. Wolf and Carl P. Spiesz. *SAE Journal*, Vol. 55, No. 7, pp. 50–52, 56, illus. (Extended abstract of a paper: Helicopter Power Plant Installations.) (Cf. AER 5/47:54.)

The Possibilities of Light Aero Engine Development. C. F. Caunter. *Aeronautics*, Vol. 16, No. 6, July, 1947, pp. 35–41, fig.

Survey of the current production of light aircraft engines shows that the field has remained comparatively static in spite of the progress achieved in the higher ratings. Future development should be toward simpler and more efficient designs. The most obvious form of unit in this connection is the two-stroke cycle engine of the gasoline or Diesel oil-injection types employing the Kadenacy system. Specifications of 111 light-aircraft engines of various countries are tabulated.

3,500 H.P. Radial Pratt & Whitney Wasp Major. *Flight*, Vol. 52, No. 2010, July 3, 1947, pp. 12a–12d, cutaway diagrs.

Engines, Rocket

The Liquid-Propellent Rocket Motor. James H. Wyld. *Mechanical Engineering*, Vol. 69, No. 6, June, 1947, pp. 457–464, illus.

A survey of the development of high-power rocket motors. The development of design from 1895 to date is outlined to show how the problems of cooling and deformation brought about by thermal stresses were overcome to permit high-combustion chamber pressures and to produce high thrusts such as are used in the V-2 rocket missile.

Technical Notes on German Rocket Development. II. Eric Burgess. *British Interplanetary Society, Bulletin*, Vol. 2, No. 4, May, 1947, pp. 69–72, diagrs. 3 references. (Cf. AER 9/47:49.)

A discussion of the fuel and starter systems of the Walter 109-509A1 rocket engine. Contains a table giving the characteristics of the rocket drives of German jet aircraft and the specifications of the Walter 109-509 rocket unit.

Report on Rocket Power Plants Based on T-Substance. Hellmuth Walter. (*Deutsche Akademie der Luftfahrtforschung, Schriften, Heft 1071, Nr. 82*, 1943.) *U.S., N.A.C.A., Technical Memorandum No. 1170*, July, 1947. 36 pp., illus. A survey of the characteristics of hydrogen peroxide and its applicability as fuel in reaction propulsion engines.

Heat Conductivity of Trinitrotoluene-Melted and Solidified. Hase. (*Hannover, Technische Hochschule*, December, 1941.) *U.S., Army Air Forces, Translation No. F-TS-3136-RE*, June, 1947. 3 pp.

Equipment and Parts

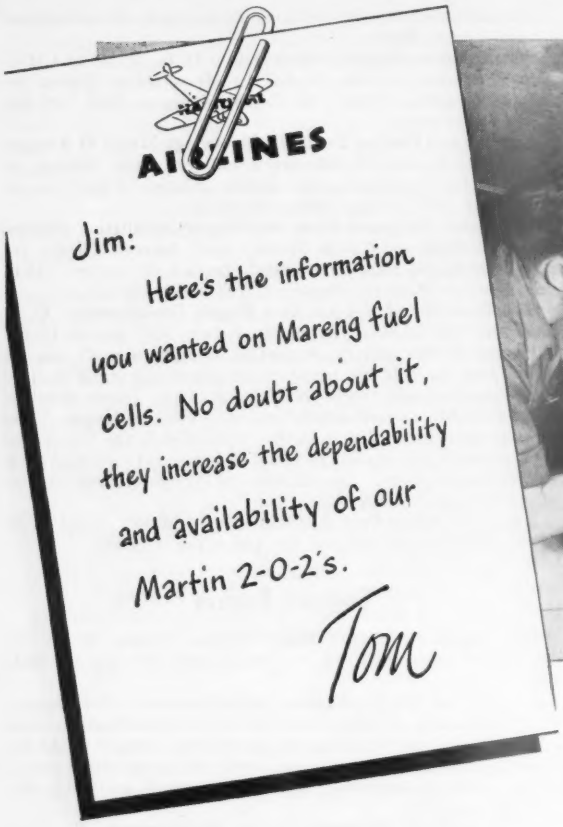
Constant-Velocity Universal Joints. E. B. Sturges. *Product Engineering*, Vol. 18, No. 7, July, 1947, pp. 120–123, illus.

A geometrical comparison of the Cardan universal joint and the Bendix-Weiss constant-velocity universal joint. The use of load-bearing steel balls that roll freely in the mating races of the yokes of the primary and secondary shafts as the power-transmitting elements accomplish the transmission of a constant angular velocity and a constant torque.

Fire Prevention

Protection of Aircraft Against Magnesium Fires. Factory Mutual Research Corporation. *U.S., Army Air Forces, Technical Report No. 5526*, August 27, 1946. 115 pp., illus.

The final report of a research and test program conducted under Army contract. Existing literature on magnesium and magnesium-base alloy compositions was searched, and commercial, underwriting, and industrial agencies were interviewed, to determine the fire hazard characteristics of these alloys. On the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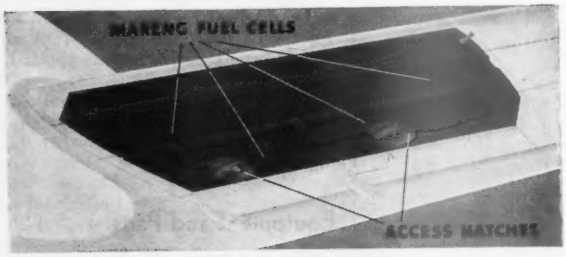

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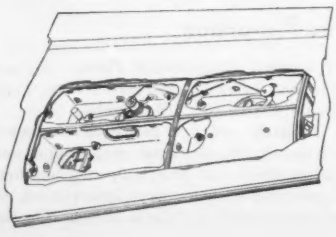

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basis of this information and the results of tests it was concluded that in present aircraft applications magnesium does not present a significant fire hazard. Under ordinary operating conditions the alloy does not ignite spontaneously; a primary source of fire must be present before it will burn. The smallest magnesium aircraft parts in use require several minutes exposure to sufficiently intense heat before igniting. This time is far in excess of the 45-sec. extinguishing time which is considered maximum for other types of aircraft fire. No practical agent for extinguishing magnesium fires in aircraft has been found. Protection lies in the rapid control of other fires that might arise.

Flight Technique

Crosswind Takeoffs. Ralph S. Johnson. *Air Transport*, Vol. 5, No. 7, July, 1947, p. 21, diagr.

Five steps are outlined for a technique of cross-wind take-off of transport airplanes which employs tail- or nose-wheel steering, landing-gear braking, the ailerons, the rudder, and engine power.

Flight Testing and Performance

Progress in Dynamic Stability and Control Research. William F. Milliken, Jr. *Journal of the Aeronautical Sciences*, Vol. 14, No. 9, September, 1947, pp. 493–519, figs. 91 references.

A discussion of an extensive flight-research and analytical research program in dynamic stability and control which is being conducted at Cornell Aeronautical Laboratory. The basic objective is to bring dynamic analysis closer to the needs of the airplane, missile, and automatic control designer through a simplification of approach and the development of methods for obtaining the required full-scale numerical data. Automatic control, in the form of modified automatic pilots, is used throughout the flight program. In Part I the significance, background, and scope of the work is reviewed. The important technical aspects are discussed in Parts II and III, which survey the work done in longitudinal motion during the past $2^1/_2$ years. Part IV outlines the future direction of the overall program. An appendix gives a survey history of dynamic research. The principal works that have followed Bryan's *Stability in Aviation*, published in 1911, are discussed, showing the development of his classical six-component theory, the introduction of a nondimensional form of the stability equations by Glauert, and the inception of flight measurements and stall studies. During the decade prior to World War II, mathematical techniques for handling the more comprehensive wind-tunnel and flight data were extended and electrical simulators were employed. Attention during this period was directed to the development of desirable flight characteristics in manually controlled airplanes. The appendix concludes with a discussion of the principal advances in America and Britain both during and since the war and with a brief résumé of advances made in Germany. Information for the résumé was obtained from discussions with German scientists.

Variation of Engine Power with Height as Determined in Flight by Indirect Method. G. S. Hislop. *Aircraft Engineering*, Vol. 19, No. 220, June, 1947, pp. 190–194, figs. 18 references.

In order to determine the respective accuracy of the British and the American formulas for the variation of full-throttle engine brake horsepower with altitude, two series of test flights were conducted. One series used a propeller that could be set at a constant pitch while the throttle setting was recorded. The other series used the drag analysis method in which the absolute performance of an aircraft is determined at low altitudes where the engine characteristics are known. The complete aerodynamic data thus obtained are then used as a reference by which to measure the aircraft performance—and, hence, the engine performance—at high altitudes. The method of calculating the brake horsepower of an engine by each of these methods is described in detail. The data obtained from the test flights is worked up according to these methods. The mean curve for engine power variation that was obtained was found to fall midway between the two standards in question and closely approximated the results obtained by the Royal Army Engineers from bench tests and engine analysis.

A Note on the Interpretation of V-g Records. P. E. Montagnon, A. Robinson, and S. V. Fagg. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2097*, January, 1945. 8 pp., figs. 3 references. British Information Services, New York. $0.60.

The disadvantage of V-g records has been that only the peak values of acceleration and speed reached during the time that any slide has been installed can be recorded. By assuming that the distribution of maneuvers of a given severity is unaffected by the distribution of those with any other severity, a method is developed for overcoming this disadvantage and a complete picture of load frequencies is established.

The Effect of the Direction of Rotation of Airscrews on Aircraft with Two Airscrews (Inverkan av Propellrarnas Rotationsriktning paa Stabiliteten hos Flygplan med Tvaa Propellrar). E. Petersohn. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 7 (FFA-Rapport AE-46)*, 1945. 17 pp., figs. Kr. 2:–. (In Swedish.)

The direction of rotation of the propellers has a marked influence on the pitching moment and the stability of an aircraft. When propellers rotate so that the upper blades move outward, there is a smaller change of moment for a change of the ratio of air speed to tip speed and better stability than with the opposite direction of rotation. The down-wash and the change of down-wash with incidence are less in the former case than in the latter. Stability is as a rule reduced more by the change of down-wash angle with incidence than it is increased by the increase of dynamic pressure resulting from the slipstream.

Experimental Verification of the Rudder-Free Stability Theory for an Airplane Model Equipped with a Rudder Having Positive Floating Tendencies and Various Amounts of Friction. Bernard Maggin. *U.S., N.A.C.A., Technical Note No. 1359*, July, 1947. 24 pp., illus. 4 references.

Tests conducted in the Langley free-flight tunnel showed that for the case of negligible friction in the rudder control system, the general rudder-free stability theory should predict adequately the period and qualitatively the damping of the rudder-free oscillations for the normal range of airplane and rudder parameters. The investigation showed that, with friction in the rudder system, a constant-amplitude oscillation exists for a range of combinations of positive-flowing moment and negative-restoring moment parameters. A simplified theory approximating solid friction by an equivalent viscous friction predicts the characteristics of the rudder-free lateral stability for values of friction hinge-moment coefficient in the rudder system which are encountered with present-day airplanes.

A Theoretical Analysis of Longitudinal Dynamic Stability in Gliding Flight. H. M. Lyon, P. M. Truscott, E. I. Auterson, and I. Whatham. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2075*, July, 1942. 43 pp., figs. 12 references. British Information Services, New York. $2.75. A summary of the theory of dynamic stability in gliding flight and an approximate method for calculating the period and damping of the phugoid.

An Experimental Investigation of the Effect of Airscrews on the Longitudinal Stability of a Twin-Engine Monoplane. V. M. Falkner, H. L. Nixon, and N. E. Sweeting. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 1270*, March 21, 1941. 29 pp., illus. 11 references.

Part of a comprehensive investigation of longitudinal stability based on the work of Bryant and McMollan which was undertaken to provide design data relative to the effect of the slipstream in association with certain factors on the tail contribution to longitudinal stability. Tests described were conducted with the main wing on the centerline of the body at 0° incidence to the body and are limited to an analysis of the down-wash and tail efficiency in terms of the movement of the neutral point which is caused by the inclusion of propellers. The total effect of airscrews on longitudinal stability may be reduced to an arithmetical sum of various component fore-and-aft movements of the center of gravity necessary to maintain neutral stability. These components are: movement of the aerodynamic center of the machine without tail; direct effect of slipstream on the tail; vertical displacement of center of gravity; vertical displacement of the thrust line; and change of pitching moment at zero lift on the wing combination.

Flight Tests of a Pursuit Airplane Fitted with an Experimental Bellows-Type Bob Weight. John R. Spreiter and James M. Nissen. *U.S., N.A.C.A., Memorandum Report (Wartime Report No. A-6)*, October, 1944. 41 pp., illus. 1 reference.

Determination of longitudinal stability characteristics of an airplane when flown with and without an experimental bellows-type bob weight. A column of gasoline in the auxiliary fuselage fuel tank was utilized as a variable bob weight in such a manner that the stick-free longitudinal stability of the craft remained essentially constant despite center-of-gravity movements due to variations of the amount of fuel in the auxiliary tank.

A Portable Two-Channel Recording Oscillograph for Battery Operation. R. F. Wild. *Instruments*, Vol. 20, No. 6, June, 1947, pp. 536–538, illus.

An instrument has been designed by the Brown Instrument Company to be used as a flight vibration recorder for the study of vibration and dynamic strain in aircraft. It is a self-contained, battery-powered, portable unit, capable of the simultaneous photographic recording of two signals of any frequency between 5 and 300 cycles per sec., with an input amplitude of from 2 millivolts to 2 volts. The weight of the unit with batteries is 35 lbs.

Thrust, Speed and Power. *Aeronautics*, Vol. 16, No. 6, July, 1947, p. 50. A brief nonmathematical exposition of the fundamental relations between power and thrust which shows how conversions may properly be made if the speed is known.

Accelerated Service Tests for Aircraft. *U.S., Civil Aeronautics Administration, Safety Regulation Release No. 243*, May 13, 1947. 11 pp.

The procedure to be followed by the Type Certification Board in setting up additional flight tests to determine the proper functioning of an aircraft and its components.

How Speed Records Are Measured. *The Aeroplane*, Vol. 78, No. 1882, July 4, 1947, pp. 11–13, illus.

The speed course that was laid out at Herne Bay in 1945 had a base length of 300,000 cm. with an error of only ±21.4 cm. The synchronization, timing, and interpretation of the moving pictures, which constituted the principal record, are described. Still cameras were used as auxiliaries. If the altitude at which the course is to be flown in the future should be raised, a vertical camera method or courses laid out by radar and radio similar to a ground controlled-approach system might be employed.

Effects of Propeller Operation and Angle of Yaw on the Distribution of the Load on the Horizontal Tail Surface of a Typical Pursuit Airplane. Harold H. Sweberg and Richard C. Dingeldein. *U.S., N.A.C.A., Advance Restricted Report No. 4B10* (*Wartime Report No. L-227*), February, 1944. 59 pp., illus. 2 references.

Compressibility Effects in the Longitudinal Stability and Control of a Pursuit-Type Airplane as Measured in Flight. William N. Turner, Paul J. Steffen, and Lawrence A. Clousing. *U.S., N.A.C.A., Advance Confidential Report No. 5I13* (*Wartime Report No. A-60*), October, 1945. 47 pp., illus. 8 references.

Measurements in Flight of the Lateral-Control Characteristics of an Airplane Equipped with Full-Span Zap Flaps and Simple Circular-Arc-Type Ailerons. J. Richard Spahr and Don R. Christophersen. *U.S., N.A.C.A., Memorandum Report* (*Wartime Report No. A-32*), September, 1944. 43 pp., illus. 6 references.

XC-35 Gust Research Project: Preliminary Analysis of the Lateral Distribution of Gust Velocity along the Span of an Airplane. A. I. Moskovitz. *U.S., N.A.C.A., Restricted Bulletin* (*Wartime Report No. L-551*), March, 1943. 21 pp., diagrs. 12 references.

Comparison of Predicted and Actual Control-Fixed Stability and Control Characteristics of a Douglas A-26B Airplane. Harold L. Crane and Sigurd A. Sjoberg. *U.S., N.A.C.A., Memorandum Report No. L5D06* (*Wartime Report No. L-608*), April, 1945. 42 pp., diagrs. 17 references.

Tests of a 0.30-Scale Semispan Model of the Douglas XTB2D-1 Airplane Wing and Fuselage Combination on the N.A.C.A. 19-Foot Pressure Tunnel. II—Roll-Flap Positioning and Lateral-Control Investigations. Stanley H. Spooner, C. Dixon Ashworth, and Robert T. Russell. *U.S., N.A.C.A., Memorandum Report* (*Wartime Report No. L-564*), September, 1944. 67 pp., illus. 4 references.

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Wind-Tunnel Investigation of the Effect of Power and Flaps on the Static Longitudinal Stability and Control Characteristics of a Single-Engine High-Wing Airplane Model. John R. Hagerman. *U.S., N.A.C.A., Technical Note No. 1339*, July, 1947. 90 pp., illus. 30 references.

The Effect of Mass Distribution on the Lateral Stability and Control Characteristics of an Airplane as Determined by Tests of a Model in the Free-Flight Tunnel. John P. Campbell and Charles L. Seacord, Jr. *U.S., N.A.C.A., Advance Restricted Report No. 3H31 (Wartime Report No. L-388)*, August, 1943. 36 pp., illus. 6 references.

Gliding and Soaring

Sailplane Performance Evaluation. August Raspet. *Soaring*, Vol. 11, No. 5–6, May–June, 1947, pp. 6, 7, figs.

Progressive improvement of sailplane design cannot be obtained until systematic series designs are developed which are based on wind-tunnel and flight data. Flight data for various current sailplane models is compared to show the improvement that might be obtained.

The Prue 160 Sailplane; Flight Testing the Prue 160. Irv Prue and Harold Huber. *Soaring*, Vol. 11, No. 5–6, May–June, 1947, pp. 14, 15, illus.

The Ross Ranger II. Vernie G. Ross. *Soaring*, Vol. 11, No. 5–6, May–June, 1947, p. 12, diagrs.

The Moswey VI. *Soaring*, Vol. 11, No. 5–6, May–June, 1947, p. 11, diagrs.

Two Polish Sailplanes. W. Czerwinski. *Aeronautics*, Vol. 16, No. 6, July, 1947, pp. 57–60, diagrs. A design study of the PWS-101 and PWS-102 gliders designed by the author.

A New British Sailplane (The Broburn Wanderlust). *Aeronautics*, Vol. 16, No. 6, July, 1947, p. 56, diagr. (Cf. AER 7/47:49.)

Convection and the Soaring Pilot. III. H. Neubroch. *Sailplane and Glider*, Vol. 15, No. 6, June, 1947, pp. 2, 3, 8, figs. (Cf. AER 9/47:00.)

Guided Missiles

Experiments on the Salvage of Fast Flying Models. Retert. (*ZWB/UM/697*, September 29, 1942.) *Cornell Aeronautical Laboratory*, June, 1947. 16 pp., diagrs.

Three different installations were tested for the salvage of high-speed missiles. Reefed and unreefed ribbon parachutes were used to effect recovery over water so that the recording instruments could be retrieved for evaluation of their records and the control mechanisms recovered for reuse. The salvage operation was initiated by an automatic timer and the parachute was ejected by an explosive charge.

The Stability of the Rotary Motions of a Projectile (Ob Ustoichivosti Vrashchatel'nykh Dvizhenii Snariada). N. G. Chetaev. *Prikladnaia Matematika i Mekhanika* (Moscow), Vol. 10, No. 1, 1946, pp. 135–138. 5 references. (In Russian.)

A. N. Krylov suggested convenient differential equations for the study of the rotary motion of an elongated projectile. Those equations lead to an exact solution of the problem of stability in cases of extremely flat trajectories. Krylov established the necessary conditions for the stability of such motion. In this paper the sufficient conditions are presented.

An Approximate Method for the Investigation of Plane Nonlinear Oscillations of a Finned Projectile (Priblizhennyi Metod Issledovania Ploskikh Nelineinykh Kolebanii Operennogo Snariada). V. S. Pugachev. *Prikladnaia Matematika i Mekhanika* (Moscow), Vol. 10, No. 1, 1946, pp. 138–152, figs. 9 references. (In Russian.)

The nonlinear equations of an oscillating finned projectile can be integrated approximately by the procedure outlined. It is assumed that the axis of the projectile oscillates in the plane of the trajectory of its center of mass.

A Universal Escape-Velocity Mass-Ratio Chart. Arthur C. Clarke. *British Interplanetary Society, Bulletin*, Vol. 2, No. 4, May, 1947, pp. 72, 73, fig. Curves are plotted for mass ratios from 1–250 against exhaust velocities from 0–15 km. per sec. at various accelerations.

Artificial Meteors; Rockets Will Provide Tools for Interstellar Measurements. F. Zwicky. *Ordnance*, Vol. 32, No. 163, July-August, 1947, pp. 18–20, illus.

Ice Prevention

In-Flight Icing of Highly Electrified Aircraft. Ross Gunn. *Journal of the Aeronautical Sciences*, Vol. 14, No. 9, September, 1947, pp. 527, 528, illus. 3 references.

In an attempt to determine whether or not a highly electrified airplane will ice up under normal icing conditions, tests were made with an artificial charger on an aircraft in flight and on electrical probes mounted on an experimental airplane. Results of test flights showed that the electrification had no measurable effect on aircraft icing.

Reports in Icing Tests for Screen in Air Intake Ducts. (*Göttingen, Aerodynamische Versuchsanstalt*, April, 1939.) *U.S., Army Air Forces, Translation No. F-TS-2625-RE*, June, 1947. 7 pp., illus. Results of tests to determine the effect of meshes of various sizes and types and of electric heating on the formation of ice on engine air intake duct screens.

Thermodynamic Design of Double-Panel, Air-Heated Windshields for Ice Prevention. Jerome L. Kushnick. *U.S., N.A.C.A., Restricted Bulletin No. 3F24 (Wartime Report No. A-56)*, June, 1943. 15 pp., figs. 2 references.

Report on Aircraft Windshield De-Icer (Electric) (Uher Co.). Lloyd R. Worden and Henry Droge. *Combined Intelligence Objectives Sub-Committee, Evaluation Report No. 332*, August 25, 1945. 1 pp. British Information Services, New York. $0.10.

Tests of De-Icers on the Me-210 Fighter Bomber. Herrmann. (*Messerschmitt A.G., VB/210-17-A-42*, March, 1943.) *U.S., Army Air Forces, Translation No. F-TS-2081-RE*, June, 1947. 6 pp., tables.

Report of flight tests of an electric direct-heat deicer. Power economy was obtained by turning on the heaters for $1^1/_2$ min. and off for 5. The ice was loosened during the heating period and removed by the air current.

De-Icing Test on the Me-210 Fighter Bomber. Aufermann. (*Messerschmitt, FB/878/237*, February, 1943.) *U.S., Army Air Forces, Translation No. F-TS-2087-RE*, June, 1947. 2 pp.

An Investigation of a Thermal Ice-Prevention System for a C-46 Cargo Airplane. VI—Dry-Air Preformance of Thermal System at Several Twin- and Single-Engine Operating Conditions at Various Altitudes. James Selna and Harold L. Kees. *U.S., N.A.C.A., Advance Restricted Report No. 5C20 (Wartime Report No. A-33)*, May, 1945. 46 pp., illus. 5 references. (Cf. AER 7/47:51.)

Development of Thermal Ice-Prevention Equipment for the B-24D Airplane. Alun R. Jones and Lewis A. Rodert. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. A-35)*, February, 1943. 40 pp., illus. 6 references.

Flight Tests of Thermal Ice-Prevention Equipment on a Lockheed 12A Airplane. Richard Scherrer. *U.S., N.A.C.A., Advance Restricted Report No. 3K10 (Wartime Report No. A-49)*, November, 1943. 34 pp., illus. 6 references.

Development of Thermal Ice-Prevention Equipment for the B-17F Airplane. Alun R. Jones and Lewis A. Rodert. *U.S., N.A.C.A., Advance Restricted Report No. 3H24 (Wartime Report No. A-51)*, August, 1943. 48 pp., illus. 2 references.

Instruments—General

An Indentation Method for Measuring Wear. *U.S., National Bureau of Standards, Technical News Bulletin*, Vol. 31, No. 7, July, 1947, pp. 75–77, illus.

The McKee Wear Gage utilizes an indentation made by forcing a diamond point into a surface that is held in a special fixture. The dimensions of the indentation are measured after wear by a conventional microscope and eye-piece scale. The gage provides indication of wear apart from other factors and does not require the careful technique required by other methods.

A New Method of Measuring Wear of Machinery Surfaces. F. G. Brickwedde. *Instruments*, Vol. 20, No. 7, July, 1947, pp. 620–622, illus. (Cf. preceding abstract.)

Multigyroscopic Vertical (Gyrohorizon) (Mnogogiroskopnaia Vertikal'). IA. N. Roitenberg. *Prikladnaia Matematika i Mekhanika* (Moscow), Vol. 10, No. 1, 1946, pp. 101–124, figs. 5 references. (In Russian.)

A development of A. N. Krylov's application of gyroscopic theory to the stabilization of a platform on a ship. Following a brief description of gyrohorizon principles, various aspects of the

application of the theory are treated analytically: differential equations of the motion of the instrument; motion of the instrument on an immovable support; the influence of rolling and acceleration of the moving ship; motion in relation to the period of free oscillations; accumulation of errors during protracted maneuvering of the ship; and ballistic deviations during transitory maneuvering of the ship and with a small period of free oscillations.

Computing and Testing Methods in the German Optical Industry. C. G. Wynne. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 874, Item No. 9.* 36 pp., diagrs. British Information Services, New York. $1.15.

Conditions in German Aircraft Instrument Industry. F. C. Cross, J. Prince, and others. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 881, Item No. 27.* 50 pp., diagrs. British Information Services, New York. $1.45.

With the exception of a pivot-rounding machine, a pivot-hardening machine, and a dig borer, the investigating team found no machines superior to those used in Great Britain. The only superior materials found were plastic gears and magnesium alloys. The survey did not include the Askania and the Zeiss Ikon works.

Instruments, Engine

Jet-Engine Instruments. C. A. Edman. *Mechanical Engineering*, Vol. 69, No. 6, June, 1947, pp. 505, 506. (Extended abstract of a paper.)

A brief description of the measuring instruments necessary for jet-engine operation. The General Electric Company's series of jet engines has required the development of a specially designed tachometer, tailpipe temperature indicator, bearing temperature gage, oil pressure gage, fuel pressure gage, and a fuel flowmeter.

The "Tachalog," Combination Tachometer and Engine-Hour Recorder. *Square D Co., Kollsman Instrument Div., Release*, Recd. July 21, 1947. 2 pp., illus.

The Tachalog provides a cumulative indication of engine hours based on an average cruising speed at 2,000 r.p.m. and eliminates the necessity of keeping an engine log. Instantaneous and steady r.p.m. indication is also provided. The instrument has no effect on the compass.

Instrument Development in Research. *Aircraft Production*, Vol. 9, No. 105, July, 1947, pp. 252–255, illus.

The following measuring instruments were developed by D. Napier & Son, Ltd. The remote distance indicator measures small movements of a system component without loading the part by observing the induction effect in a small transformer with a moving armature. An aeration meter measures the amount of air mixed with engine oil by comparing the dielectric coefficient of the mixture as it passes through the plates of a capacitor with that of samples of pure lubricant. Detonation is indicated on a cathode-ray scope by using a pickup that operates on the magnetostriction effect.

Three New Photoelectric Instruments for High-Speed Engine Research. Kalman J. DeJuhasz. *Automotive Industries*, Vol. 97, No. 1, July 1, 1947, pp. 36–39, 60, illus.

Descriptions of a photoelectric pressure indicator, a torsiograph, and an injection needle-valve lift indicator. The photoelectric pressure indicator was designed by H. Maihak A.G., Hamburg, Germany. The vertical deflection of the electron beam of a cathod-ray oscillograph is determined by the intensity of the light reflected from a diaphragm that flexes as a function of the cylinder pressure. The abscissa variable of the reading is obtained from a pickup in which a shaft is driven or synchronized with the engine crankshaft. An appropriately designed blanking disc in the end of the shaft varies the amount of light received by a photoelectric cell to correspond with the crank angle or the piston stroke. The torsiograph was designed as an experimental model by Dr. Kurt Hoppe at the Berlin engineering university. The angular displacement of an inertia wheel relative to a hollow shaft is measured by variations in the intensity of the light received from a source within the hollow shaft. The light is transmitted through two sets of radial apertures. One set is on the end of the shaft; the other set is in the inertia wheel. The injection needle-valve lift indicator was developed by Dr. Norman Kendall at King's College, London. An extension rod fastened to the needle valve carries a slotted screen. This acts as a shutter, varying the light delivered to a photoelectric cell in proportion to the position of the needle.

Calibration of Three Temperature Probes and a Pressure Probe at High Speeds. W. F. Lindsey. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-273)*, April, 1942. 15 pp., illus. 1 reference.

New Fuel Quantity Gage in Use. *Naval Aviation News (Naval Air Reserve Edition)*, No. 272, July, 1947, p. 27, illus.

The Bureau of Aeronautics has adopted a fuel gage that measures gasoline electronically. The transmitter is an electrostatic capacitor in the form of two concentric metal tubes mounted vertically in the gas tank. As the air or fuel is displaced in the space between the plates, the capacitance is changed. An electronic circuit interprets the capacitance measurement in terms of pounds of fuel in the tank.

The Activities and Products of the Firm of Bopp and Reuther GmbH Neckergemund with Special Reference to Fluid Flowmeters. K. R. Honick. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 1193.* 7 pp., diagrs. British Information Services, New York. $0.35.

The fluid flowmeters manufactured by this company measure both the volume and the rate of flow. They employ oval gears that produce a torque sufficiently high to drive Veeder-type counters by direct gearing or by a flexible shaft for remote indication.

Instruments, Flight

Towards Happier Landings. T. Townson. *Flight*, Vol. 51, No. 2009, June 26, 1947, pp. 603–605, illus.

The Sperry A-12 Gyropilot is a "displacement-plus-rate" instrument that can control an aircraft at any operating speed without adjustment in flight. Its advantage when used in automatic approach lies in the fact that it not only compensates automatically for drift and maintains the aircraft on the localizer and glide-path beam but, on return to manual control, the aircraft is correctly trimmed and no excessive manual adjustments of control surfaces are required.

Sonic Speed Warnings. *Flight*, Vol. 51, No. 2008, June 19, 1947, pp. 579, 580, 585, illus.

The Kelvin, Bottomley and Baird maximum safe-air-speed indicator shows simultaneously the air speed and the maximum safe air speed at which the aircraft may be flown. The instrument automatically compensates for changes in flight altitude. The dial of the instrument has two pointers. The one that indicates the air speed is controlled by a conventional air-speed indicator mechanism. The other, which indicates the maximum safe speed, is controlled by a sensitive altimeter and is preset in accordance with the characteristics of the aircraft. The Kelvin Mach meter employs the same two elements as the safe-speed indicator but gives a single indication. The air-speed data is modified by an altimeter and a single pointer gives the Mach Number. This meter is calibrated to an accuracy of ± 0.01 Mach over its whole indicating range for temperatures from $-20°$ to $+50°$C.

Towards Greater Safety; American Aviation Aids, Developments of Square D Company. *Modern Transport*, Vol. 57, No. 1474, June 29, 1947, p. 7.

Descriptions of an altimeter setting indicator, giving continuous accurate reading of sea-level pressures and the angle-of-attack indicator developed by the Kollsman Instrument Division of the Square D Company.

Landing Gear

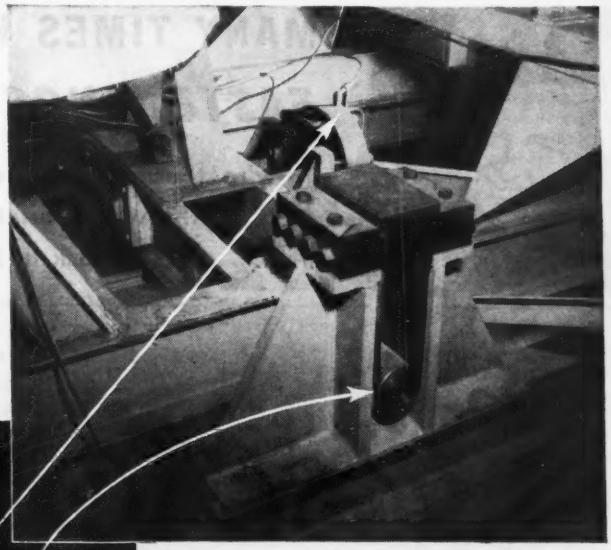
Design and Manufacture of Aircraft Tyres. J. Webb and H. D. Burke. *Shell Aviation News* (London), No. 108, June, 1947, pp. 16–19, illus.

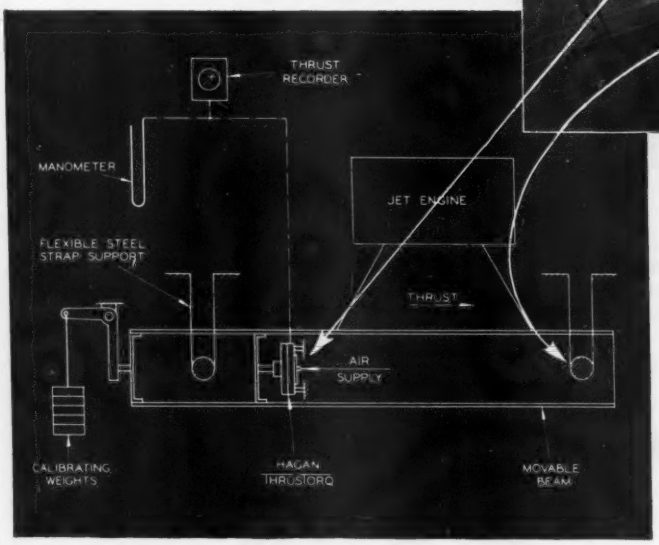
Lubrication and Lubricants

Structural Viscosity as the Cause of Lubricating Properties. H. Umstätter. (*Die Technik* (Berlin), Vol. 1, No. 1, July, 1946, pp. 46–52.) *The Engineers' Digest*, Vol. 4, No. 6, June, 1947, pp. 264–272, diagrs.

Viscosity depends not only upon temperature and pressure but also upon the velocity gradient. "Structural viscosity" resulting from the effects of velocity gradients is a common property of liquids of all molecular weights. The selection of a lubricant of

Measuring Thrust of jet engines with Hagan THRUSTORQ





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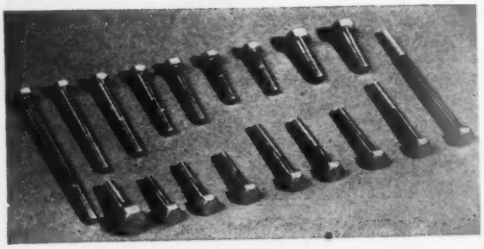

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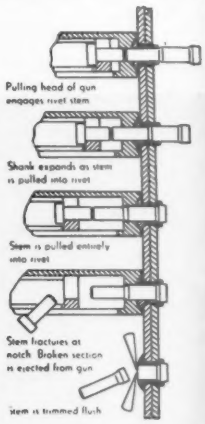
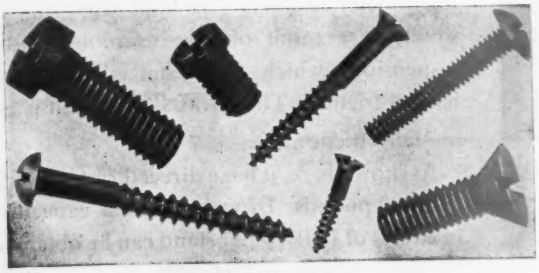

Pulling head of gun engages rivet stem
Shank expands as stem is pulled into rivet
Stem is pulled entirely into rivet
Stem fractures at notch. Broken section is ejected from gun
Stem is trimmed flush



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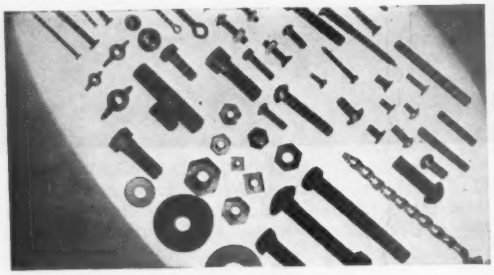

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suitable structural viscosity, for which the velocity gradient can exceed those of normal viscous lubricants, will produce a hydrodynamic pressure in excess of those of conventional oils. It follows that the hydrodynamic pressure graph will be flattened and thus represent a more uniform distribution of pressure on the surface of the bearing.

Maintenance

The Repair of Avro Aircraft. Roy Chadwick. *Aircraft Engineering*, Vol. 19, No. 220, June, 1947, pp. 199–205, diagrs. Details of typical repairs made on the air frames of Lancaster, York, and Anson aircraft.

Ensuring Air Safety; Inspection Methods of A. B. Aerotransport. *Modern Transport*, Vol. 57, No. 1473, June 21, 1947, p. 7.

Inspection and Repair of DC-4 Tail Surfaces. James M. Linde. *Air Transport*, Vol. 5, No. 7, July, 1947, pp. 58, 59.

Maintenance Job Methods. VI—Douglas DC-4 and Lockheed Constellation (L-49). James M. Linde. *Air Transport*, Vol. 5, No. 7, July, 1947, pp. 62, 63, diagr. (Cf. AER 9/47:57.)

Specifications and procedure for adjusting the flap door rigging of the DC-4. Maintenance and inspection directions are given for the control column and for lubrication of elevator spring cartridge and rudder deboost linkages of the L-49.

Materials—General

Specialised Ceramic Materials with Particular Reference to Ceramic Gas Turbine Blades. W. Watt, A. L. Roberts, and others. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 470, Item Nos. 21, 22.* 34 pp., tables. British Information Services, New York. $1.00.

A description of the plant and processes used by Degausa in the production of articles in pure sintered oxides, mainly alumina, but also in magnesia, beryllia, zirconia, thoria, and magnesium spinel. An appendix reproduces the translations of six research reports obtained from the firm: Research on Calcined Alumina, Dry Cast Articles Made of Sintered Alumina, The Grinding of Calcined Alumina, Method of Testing Calcined Alumina for Small Quantities of Magnesium, and Vacuum Mixing Experiments.

Chemistry in Quality Control. Richard B. Faurote. *Aero Digest*, Vol. 55, No. 1, July, 1947, pp. 78, 124, illus.

An outline of the work of the chemist in the manufacture of Ranger aircraft engines. The function and application of the spectrograph, absorption spectroscopy, the spectrophotometer, electric titration, and diffraction X-ray to production control are briefly described.

Textiles for Aircraft. John S. Trevor. *Aeronautics*, Vol. 16, No. 6, 1947, p. 65.

Materials—Metals and Alloys

Investigations Concerning the Suitability of Heat-Resisting Materials for Exhaust-Gas Turbine Blades. H. Cornelius, W. Bungardt, and F. Bollenrath. (*Deutsche Versuchsanstalt für Luftfahrt ZWB/FB/867/3.*) *U.S., Army Air Forces, Translation No. F-TS-1862-RE*, June, 1947. 17 pp., figs.

Tests were made on 22 austenitic materials at temperatures between 600° and 1000°C. in order to determine their suitability as structural parts subject to centrifugal force at high temperatures and to determine which materials permit considerable expansion without undue danger of fracture. Results are tabulated and plotted.

High-Creep Strength Austenitic Steel for Gas Turbines. D. A. Oliver and G. T. Harris. *Engineering*, Vol. 163, No. 4247, June 20, 1947, pp. 533–536, figs. (Extended abstract of a paper.)

An outline of the research that led to the development of the G.18B austenitic steel from valve steel G.2. Heat-treatment improved the creep strength, and a change of the additives increased the ductility. It was found that further increase of creep strength could be obtained by subjecting the steel, after heat-treatment to about 1,300°C., to plastic deformation. X-ray examination of the carbides and other phases extracted electrolytically led to the conclusion that the different carbide-formers control the creep strength mainly through their influence on the precipitating phases and not on the matrix solid solution itself.

Japanese Metallurgy; High Temperature Alloys for Gas Turbines, Rocket Nozzles and Lines. U.S., Naval Technical Mission to Japan. *Gt. Brit., British Intelligence Objectives Sub-Committee, Report No. B.I.O.S./J.A.P./P.R./583*, November, 1945. 12 pp., tables. British Information Services, New York. $0.35.

The shortage of nickel and cobalt led to the development of a series of high-temperature steels that did not contain these two elements. Their chemical composition, physical properties, and heat-treatment are tabulated. An abstract of researches at Tohoku Imperial University on "Mn-Cr-Steels as Heat Resisting Materials" is included.

Effect of Artificial Aging on Tensile Properties and Resistance to Corrosion of 24S-T Aluminum Alloy. Hugh L. Logan, Harold Hessing, and Harold E. Francis. *U.S., National Bureau of Standards, Journal of Research*, Vol. 38, No. 5, May, 1947, pp. 465–489, illus. 9 references.

Materials aged 3 to 10 hours at 385°F. and 6 to 12 hours at 375°F. were generally immune to stress corrosion cracking, showed an increase in strength values, and were as resistant to surface corrosion as commercially heat-treated samples without artificial aging.

An Experimental Determination of the Fatigue Diagram for Alclad Sheet Specimens with Rivet Holes, Subjected to Tension and Compression (Experimentell Bestämning av Utmattningsdiagrammet för Nithalsförsedda Provstavar av Alcladplaat vid Drag- och Tryckbelastning). G. Waallgren. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 14 (FFA-Rapport HE-86:2)*, 1946. 13 pp., diagrs. 4 references. Kr. 1:50. (In Swedish.)

The results of static tests show that the ultimate stress of the specimens with holes, which is based on the net area, is about 7 per cent less than that of the sheet without holes. The results of fatigue tests on the specimens with holes are given in the form of fatigue curves that show how the maximum cycle stress varies as a function of the number of cycles to failure for different values of the mean cycle stress. The notch sensitivity of the material and the effect of the surface finish on the fatigue strength have been calculated and show that the notch sensitivity varies with the mean cyclic stress and the number of load cycles to failure. The fatigue strength of the unpolished specimens is lower than that of the polished specimens.

An Experimental Determination of the Fatigue Diagram for Tension and Compression in the Alclad Sheet (Experimentell Bestämning av Utmattningsdiagrammet vid Drag-och Tryckbelastning av Alcladplaat). S. Luthander and G. Waallgren. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 5 (FFA-Rapport HE-106)*, 1944. 12 pp., diagrs. Kr. 1:50. (In Swedish.)

Tests were made to determine the fatigue diagram for 1.2 mm. Alclad sheet subjected to tension and compression. The test specimens were taken so that their long sides lay in the direction of rolling of the plate. The number of stress cycles which produced failure was determined by experiment for various values of the mean stress. A device for stabilizing the plate specimens against buckling was employed which made it possible to test them in compression. This permitted the fatigue diagram to include alternating stresses as well as pulsating tensions.

Survey of Secondary Aluminum Industry in Germany. Julius Jakobi, P. T. Priestman, and F. Farenden. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 1099.* 26 pp., diagrs. British Information Services, New York. $1.00.

Static and Dynamic Tests of Attachment Bolts of High Alloy Steel (Statiska och Dynamiska Prov paa Koppelbultar av Högvärdigt Material). S. Luthander and G. Waallgren. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 4 (FFA-Rapport HR-84)*, 1944. 16 pp., illus. Kr. 2:–. (In Swedish.)

Tests of joints fastened by bolts of chromium-nickel-molybdenum steel and chromium-molybdenum steel showed that, for a given value of the tensile strength of the bolt, the fatigue strength was inversely proportional to the hardness of the material in the nut. An increase of the ultimate static strength by increasing the hardness of the screw did not always result in an increase in the fatigue strength of the joint. By slanting off the first threads, the stress concentration at the first threads can be diminished. This results in better fatigue strength. If the steel nut is replaced by a nut of duralumin (24 ST), the fatigue limit increases. Such a nut, however, must be very tall in order to have a static strength equal to that of the bolt.

The Fatigue Qualities of a Chromium Alloy Steel for Pulsating Tensile Stresses (Utmattningsegenskaperna hos ett Cr-Legerat

Konstruktionsstaal vid Pulserande Dragbelastning). A. Luthander and G. Waallgren. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 13 (FFA-Rapport HE-85)*, 1945. 22 pp., diagrs. 4 references. Kr. 2:–. (In Swedish.)

An experimental investigation to determine the fatigue strength and the variation of notch sensitivity with stress limits for a chromium-alloy steel with four different values of ultimate static strength. The test pieces include a number of bars with different kinds of notches and other stress raisers with different stress concentration factors in order to make clear the effect of notch sensitivity.

Spectrographic Analysis of Stainless Steels. D. P. Jensen. *The Iron Age*, Vol. 160, No. 3, July 17, 1947, pp. 47, 48. 5 references.

In stainless steel the iron content varies so greatly that it is not practical to use the intensity of its spectrographic line as a standard for determining the percentage of the other elements present. A method of analysis has been developed by the Douglas Aircraft Company, Inc., in which, for each sample analyzed, an "internal standard" is established that is unique for the chemical composition of that sample. A value of unity is assigned to iron, and the ratio of the atomic percentage of a given element in the sample to the atomic percentage of the iron present is assumed to be a function of the ratio of the intensity of the spectrum line of the given element to the spectrum line of the iron. The internal standard, then, is that spectrum-line intensity which is the summation of the intensities contributed by each element according to its relative atomic percentage content. By the use of this method it has been possible to obtain complete analysis for all the metallic elements in members of the stainless-steel group which differ widely in composition.

The Kaiser-Wilhelm Institut für Eisenforschung, Düsseldorf. G. J. Thiessen. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 205, Item No. 9.* 8 pp., figs. British Information Services, New York. $0.35.

A description of the method of using X-rays in stress measurement. The results obtained by this method are compared with those obtained by mechanical methods. Measurements of stress changes in a rod during break tests and measurements on a rod subjected to oscillating stress are described.

Research Laboratory Deutsche Edelstahlwerke A.G., Krefeld. T. P. Colclough. *Combined Intelligence Objectives Sub-Committee, Item No. 21, File No. 31–47.* British Information Services, New York. 18 pp., figs. $0.55.

Japanese Metallurgy; Atomic Structure Relative to Dynamic Properties. U.S. Naval Technical Mission to Japan. *Gt. Brit., British Intelligence Objectives Sub-Committee, Report No. B.I.O.S./J.A.P./P.R./579*, November, 1945. 14 pp., figs. British Information Services, New York. $0.55.

German Theories and Accomplishments in the Field of Stress-Corrosion Cracking. Charles A. Naugle. *U.S., Army Air Forces, Technical Report No. F-TR-1131-ND*, June, 1947 78 pp., illus. 15 references.

An extensive study of German knowledge of stress corrosion and intergranular corrosion in aluminum-alloy systems, based on German literature available in the United States. A few of the papers consulted date back to the 1930's, but the more significant papers were published in 1944.

Magnesium-Cerium-Zirconium Alloys. A. J. Murphy and R. J. M. Payne. *Engineering*, Vol. 163, No. 4245, June 6, 1947, pp. 485–487, illus.

At room temperature the mechanical properties of sand-cast magnesium-cerium alloys are poor. Since, in the presence of cerium, zirconium retains its ability to refine the grain of cast magnesium, its addition to cast magnesium-cerium alloys produces a refinement of grain structure. Proof stress, ultimate stress, and ductility of the alloy are considerably increased.

The German Magnesium Industry. *Gt. Brit., British Intelligence Objectives Sub-Committee, Miscellaneous Report No. 5.* 100 pp., tables. New York, British Information Services. $2.75. A survey of the principal magnesium producing and fabricating plants in Germany and the production and forming processes in use.

Metallurgical Examination of Armour Plate from Japanese Type I F "Oscar" Mark II SE Fighter. L. H. Grenell, J. R. Cady, and others. *Gt. Brit., British Intelligence Objectives Sub-Committee, Report No. B.I.O.S./J.A.P./P.R./1444*, June 8, 1944. 9 pp., illus. British Information Services, New York. $0.35.

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Materials—Plastics and Plywood

Theory of the Elastic Properties of Orthotropic Sheets Stressed by Force Systems in Their Own Plane; Application to Birch Plywood (Teori för Elastika Egenskaper hos Ortotropa Plattor, Belstade av Kraftsystem i Plattaans Plan, Jämte Tillämpning paa Kryssfaner av Björk). B. Andersson and B. Bergqvist. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 12 (FFA-Rapport HE-99)*, 1945. 99 pp., illus. 4 references. Kr. 9:50. (In Swedish.)

Formulas for the necessary stiffness functions are developed to show their variation with the angle formed by the grain with any arbitrary set of coordinates. Tests were performed on Swedish plywood and the results were plotted as curves that showed the variation of the stiffness functions with the angular relation between the coordinates selected and the grain. The function for determining the stress from the strains is called the "stress coefficient" and that for determining the strains from the stress is called "modulus." This modulus may represent either Young's modulus for normal forces; the shear modulus for tangential forces; the modulus expressing Poisson's ratio; or, finally, an expression that represents the fact that the strain, in general, also has a dependence on shear stresses and that shear strain, in particular, likewise has a dependence on normal stresses.

An Empirical Investigation of the Static Strength of Birch Plywood Joints with Short Bolts (Experimentell Undersökning Rörande den Statiska Haallfastheten hos Förband med Korta Bultar i Björkskiktträ). S. Luthander and G. Waallgren. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 11 (FFA-Rapport HE-149)*, 1945. 28 pp., illus. 4 references. Kr. 3:–. (In Swedish.)

The test specimens were cut from sheets of Finish plywood 2 mm. thick. Each layer was 0.29-mm. thick. Every tenth layer was placed with the grain running at right angles to the other layers. The pile was bonded with a Bakelite film under 2 atmospheres pressure. The test results for the ultimate strength of the joints were expressed as a ratio of the ultimate stress of t

joints divided by the ultimate strength of the wood, giving nondimensional "strength coefficients." Test results with constant bolt diameter and constant specimen thickness were plotted to obtain curves from which the ultimate strength of a joint could be calculated. The nominal strength of a joint increased somewhat as the diameter of the bolt decreased, while a reduction in the thickness of the wood, with the bolt diameter constant, caused a negligible increase in the nominal ultimate strength. The information from these tests was extended to calculate the strength of a joint with several bolts. Results of the calculations showed good agreement with test results.

The Static and Dynamic Shear Stress of Glued Joints of Birch and Walnut at Two Different Temperatures (Statisk och Dynamisk Skjuvhaallfasthet hos Limförband i Björk- och Valnötträ vid Tvaa Temperaturer). S. Luthander and G. Waallgren. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 2 (FFA-Rapport HE-55)*, 1944. 25 pp., diagrs. Kr. 3:–. (In Swedish.)

Comparison of shear and fatigue strength of joints made with casein, synthetic resin (Kaurit), and bone glue. Bonds tested were made in Swedish birch and American walnut as used in propeller construction. Results indicated that the three glues used had about the same shear strength. In those cases in which the joint was subjected to moisture, bone glue was not satisfactory, and casein glue was somewhat superior to synthetic resin glue. Each of the three glues had about the same fatigue strength. At elevated temperatures under moist conditions, bone glue was unsatisfactory. Joints that displayed the highest static strength also showed the highest fatigue strength under identical conditions.

Effect of Catalysts and pH on Strength of Resin-Bonded Plywood. G. M. Kline, F. W. Reinhart, and others. *Modern Plastics*, Vol. 24, No. 11, July, 1947, pp. 123–128, figs. (Abridged from *U.S., N.A.C.A., Technical Note No. 1161.*) (Cf. AER 2/47:59.)

Effect of Simulated Service Conditions on Plastics. W. A. Crouse, D. C. Caudill, and F. W. Reinhart. *U.S., N.A.C.A., Technical Note No. 1240*, July, 1947. 31 pp., illus. 3 references.

The results of tests made to determine the effects of outdoor weathering, accelerated weathering, and accelerated service conditions on the weight, dimensions, and flexural properties of laminated plastics and macerated-fabric-filled phenolic plastics. The accelerated weathering test involved exposure to cycles of ultraviolet light and fog. The accelerated service tests involved exposure to cycles of various temperatures and relative humidities. With all factors considered, the asbestos-fabric phenolic laminate and the glass-fabric unsaturated-polyester laminate were found to be the most resistant materials of those tested. None of the laboratory aging tests correlated with outdoor weathering with respect to all properties and all materials.

New Plastics for German Aircraft (Structural Materials, Glazings, and Paints). James T. Grey. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report, No. 762*, September, 1945. 12 pp. British Information Services, New York. $0.55.

Study of New Adhesives Produced by I. G. Farbenindustrie A.G., Leverkusen. Kyle Ward, Jr. *U.S., Field Information Agency, Technical, Final Report No. 391*, October 9, 1945. 14 pp. British Information Services, New York. $0.55.

The properties, handling, and application of Desmodur R a, tri-isocyanate derived from tri-(*p*-aminophenyl) methane, to the bonding of synthetic fibers and synthetic rubber.

The Case of Material X. *Owens-Corning Fiberglas Corp.*, 1947. 8 pp., illus.

A process has been newly developed for the volume production of Fiberglas-reinforced plastic products. These materials have greater strength for weight than metals. They have no permanent deformation almost to the ultimate breaking point and are noncorrosive, are heat and moisture resistant, and are dimensionally stable. Unidirectional and multidirectional strength properties may be altered by design, forming, and laminating.

Plastics and Wood for Aircraft Tooling and Fabrication. L. M. Harris and J. T. Grey. *U.S., Field Information Agency, Technical, Final Report No. 446*, February 28, 1946. 34 pp., illus. British Information Services, New York. $1.00.

I. Bruning & Sohn (Ibus), Luneburg. D. K. Macfarlane. *Gt. Brit., British Intelligence Objectives Sub-Committee, Evaluation Report No. 6*, 1946. 2 pp. British Information Services, New York. $0.10.

Medicine

Studies Pertaining to the Design and Use of Visual Displays for Aircraft Instruments, Computers, Maps, Charts, and Tables; A Bibliography. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-1G*, June 30, 1947. 25 pp. 264 references.

This bibliography constitutes a preliminary report of work being done to summarize the literature on the display, design, and use of instruments and other material that must be read in aircraft. A total of 264 scientific reports are listed which relate to instruments, computers, maps, charts, tables, or to particular conditions under which these devices are used. In general, no articles have been included on night vision, reading, visual illusions in flight, or peripheral acuity. Those inclusions not seen by the compilers and those articles reviewed in the annotated bibliography of Lawrance and MacMillan are so designated.

Pilot Reaction Time: The Time Required to Comprehend and React to Contact and Instrument Recovery Problems. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-13a*, May 26, 1947. 13 pp., illus.

A series of tests was made to determine the time required by a pilot to comprehend the attitude of an airplane and initiate control movements to return it to level flight. Typical pilots can interpret the actual horizon approximately $^1/_5$ sec. faster than they can interpret their instruments. They can recover, under contact conditions, approximately $1^1/_2$ sec. faster than under instrument conditions.

A Study of Several Design Factors Influencing Pilot Efficiency in the Operation of Controls. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-9*, November 12, 1946. 20 pp., illus. 7 references.

The Accuracy of Pilots and Non-Pilots in Applying Pressures on a Control Stick. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-3*, August 15, 1946. 19 pp., diagrs. 10 references.

The Accuracy of Pilots in Applying Pressures on a Wheel-Type Control. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-3A*, September 4, 1946. 10 pp., fig. 2 references.

The Accuracy of Pilots in Applying Pressures on Rudder Pedals. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-3B*, September 4, 1946. 12 pp., fig. 5 references.

A Further Investigation of Shapes for Use in Coding Aircraft Control Knobs. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-4B*, September 26, 1946. 11 pp., illus.

Design of Aircraft Switch Panels for Maximum Ease of Checking of Switch Position. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-4F*, April 14, 1946. 5 pp., diagrs.

Direction of Movement in the Use of Control Knobs to Position Visual Indicators. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-4C*, April 30, 1947. 15 pp., diagrs.

Effect of Moderate Positive Acceleration (g) on Ability to Read Aircraft-Type Instrument Dials. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-10*, November 15, 1946. 13 pp., illus. 4 references.

Preliminary Studies of the Effect of Vibration, Illumination, and Type Size on Legibility of Numerals. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-1F*, June 23, 1947. 20 pp.

Psychological Factors Involved in the Design of Air Navigation Plotters. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-1D*, December 5, 1946. 25 pp., diagrs.

The Relative Effectiveness of Presenting Numerical Data by the Use of Tables and Graphs. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-1*, April 17, 1946. 17 pp., figs.

A Study of the Best Design of Tables and Graphs Used for Presenting Numerical Data. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-1C*, September 24, 1946. 16 pp., figs

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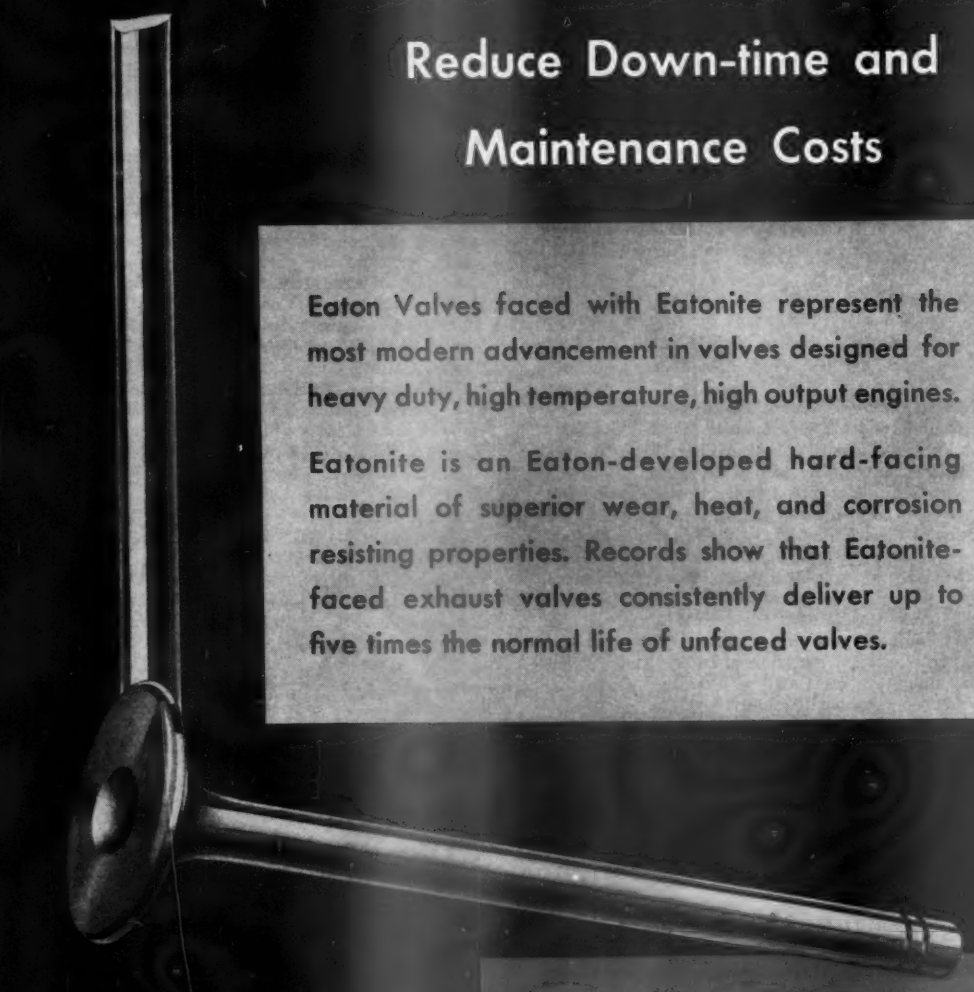

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Legibility of Printed Materials. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-1A*, June 10, 1946. 27 pp. 13 references.

Design of Clock Dials for Greatest Speed and Accuracy of Reading in Military (2400 Hour) Time System. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-8*, October 21, 1946. 16 pp., diagrs.

Some Typical Sky and Earth Brightnesses at Altitudes 10,000 to 40,000 Feet and Their Relationship to the Eye-Adaptation Problems of the Radar Operator. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-11*, December 9, 1946. 16 pp., figs. 23 references.

The Comparative Interpretability of Two Methods of Presenting Bombing Information by Radar. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-5*, October 10, 1946. 20 pp., illus.

Effects of Friction and Mode of Operation upon Accuracy of Tracking with the G. E. Pedestal Sight. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-2c*, March 17, 1947. 10 pp. 4 references.

Modifications of the AAF S.A.M. Pedestal Sight Manipulation Test. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-2B*, November 25, 1946. 9 pp., illus.

An Experimental Comparison of the Accuracy of Tracking, Ranging and Triggering with Two New-Type Gun-Sight Hand Controls. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-694-2a*, October 25, 1946. 12 pp., illus. 5 references.

Experimental Comparison of Sighting and Triggering Performance with Hand Grips as Compared to Hand Wheel Controls on the B-29 Pedestal Sights. *U.S., Army Air Forces, Air Matériel Command, Aero Medical Laboratory, Memorandum Report No. TSEAA-8-694-2*, May 28, 1946. 15 pp., illus.

Meteorology

On Periods and Symmetry Points in Pressure as Aids to Forecasting. Sir Gilbert Walker. *Royal Meteorological Society, Quarterly Journal*, Vol. 72, No. 314, October, 1946, pp. 265–278, figs. Discussion, pp. 279–283. 8 references. A mathematical analysis of the validity of long-range weather forecasts based on the assumption of the reality of pressure waves and symmetry points.

Meteorological Aspects of Record Long-Range Army Flights. Delmar L. Crowson. *American Meteorological Society, Bulletin*, Vol. 28, No. 5, May, 1947, pp. 220–227, diagrs. A description of the weather planning preliminary to the flight of the Dreamboat II from Oahu to Cairo.

Dynamical Aspects of the Constancy of Air Density at 8 Km. Mariano Doporto. *Ireland, Meteorological Service, Dublin, Technical Note No. 2 (Advance Issue)*, October 26, 1943. 77 pp., diagrs. 24 references.

The practical and theoretical significance of the existence of the tropospheric isopycnic. The existence of density waves and an isopycnic layer is given as an explanation of the maximum or pressure variability observed at about 8 km. An isobaric chart for the 8-km. level should give the best possible representation of tropopause waves.

Forecasting the Time of Formation of Stratus Cloud Ceiling at Oakland, California, Airport. Edward M. Vernon. *U.S., Weather Bureau, Research Paper No. 23*, April, 1945. 9 pp., fig.

The Nucleation of Ice Formation by Silver Iodide. B. Vonnegut. *Journal of Applied Physics*, Vol. 18, No. 7, July, 1947, pp. 593–595.

A Theoretical Note on Some Errors in Estimating the Curvatures of Air Trajectories and Streamlines. G. L. Hogben. *Royal Meteorological Society, Quarterly Journal*, Vol. 72, No. 314, October, 1947, pp. 318–322. 2 references.

On the Frictional Influence of Horizontal Wind Shear on Vertical Motion. C. H. B. Priestley. *Royal Meteorological Society, Quarterly Journal*, Vol. 72, No. 314, October, 1947, pp. 284–289, figs. 5 references.

Naval Aviation

Shipboard Jets. *Western Flying*, Vol. 27, No. 7, July, 1947, pp. 26, 28, 36, illus.

A survey of some of the problems of jet aircraft operating from carriers, such as timing of take-off and landing, arresting gear crash barriers, danger from jet blast, fueling and arming, slow acceleration and the use of catapults, and maintenance.

Navigation

The German Gyro-Sextant. Mary R. Hunt. *Navigation*, Vol. 1, No. 6, 1947, pp. 138–141, illus.

The instrument is fundamentally the German bubble sextant with the bubble replaced by a gyro-unit. An optical arrangement, whereby the image of the observed body appears to be superimposed on the artificial reference lines established by the gyro, and a timing mechanism and averaging device, together with the scales, enable the observer to read immediately the mean altitude corresponding to the mid-time of the observation.

Report on Navigation of Pacusan "Dreamboat" Flight. Norman P. Hays. *Navigation*, Vol. 1, No. 6, 1947, pp. 142–148, diagrs.

Parachutes

Free-Falls and Parachute Descents in the Standard Atmosphere. A. P. Webster. *U.S., N.A.C.A., Technical Note No. 1315*, June, 1947. 30 pp., figs. 6 references.

A compilation of altitude, velocity, and time relationships for free-falls and open-parachute descents. These values have been tabulated for the situation in which the weight of the jumper equals the drag in the standard atmosphere.

Photography

Fairchild Radar Camera. *Fairchild Camera and Instrument Corp., Release*, Recd. July 18, 1947. 2 pp.

The application of the radar oscilloscope recording camera of the Fairchild Camera and Instrument Corporation has been extended to aircraft navigation. Known as the Mira camera, it simultaneously records radar images with range setting, time, exposure, counter, and hand-written information on each 35-mm. frame. It is fully automatic, prefocused, and it does not interfere with the operator's view of the radar scope. Its particular application is in the preparation of charts of airline routes.

Radar Scope Photography. Richard C. Babish. *Society of Motion Picture Engineers, Journal*, Vol. 48, No. 5, May, 1947, pp. 454–472, illus.

The best still pictures of the image formed on the P-7 radar scope were obtained by using a fine-grain panchromatic or orthochromatic film at f/3.5 with a blue filter that permitted only the instantaneous blue generating trace to be photographed. Since motion pictures must reproduce the picture seen by the operator, the Fairchild Camera and Instrument Corporation designed the O-5-A camera, which records on a 35-mm. sound frame the radar picture and time and code data. Two RCA beam splitters allow the picture to be made by the blue nonpersistent component while the operator views the yellow component.

Cartographic Camera. *Fairchild Camera and Instrument Corp., Release*, Recd. June 25, 1947. 2 pp., illus.

The Fairchild Camera and Instrument Corporation has produced a new Cartographic Camera for precision mapping. The design is such that the negatives may be used in the multiplex projector and other stereoscopic plotting instruments. The magazine accommodates 180 ft. of film and provides for 250 9 by 9 in. exposures.

Production—General

German Activities in the French Aircraft Industry. *Combined Intelligence Objectives Subcommittee, Item No. 25, File No. 17-1.* 192 pp., illus. British Information Services, New York. $4.25.

A report covering inspections of approximately 14 French aircraft factories and research installations during December, 1944, and January, 1945. All the establishments had been used in some way by the Germans and were engaged in producing complete German aircraft and components, designing new aircraft,

and performing maintenance and repair. Some continued the manufacture of French aircraft. Little new information was obtained on German tools, planning, or layout methods.

The Arsenal de l'Aéronautique Chatillon-sous-Bagneux. James Hay Stevens. *Aircraft Engineering*, Vol. 19, No. 220, June, 1947, pp. 178–183, illus.

A development aircraft factory. It was founded in 1936 to produce prototypes of air frames and engine coupling equipment for the nationalized French aircraft industry. Current work includes completion of prototypes of the VB-10; a photographic reconnaissance single-seater; prototypes of the VG-70, which is a sonic research monoplane; and trials and development of the 24-H engine.

Production Methods

A Review of Production Problems in Relation to Aircraft Design. C. E. Fielding. *Royal Aeronautical Society, Journal*, Vol. 51, No. 438, June, 1947, pp. 511–525, Discussion, pp. 525–533, illus.

The high-speed production required of wartime industry gave the production engineer an influence greater than normal on aircraft design. Although at times the final product was a compromise between the ideal of the designer and the man-hour, floor-space, speed economy of the production engineer, many examples are cited to illustrate the increase in overall production efficiency attained by assembly and by detail modification without prejudice to aerodynamic and weight requirements.

Skin Stretching: Avro Developments in Forming Large Airframe Panels. *Aircraft Production*, Vol. 9, No. 105, July, 1947, pp. 243–248, illus.

The Avro aircraft-skin stretching machine, developed by A. V. Roe and Company, Ltd., forms the component skin section by stretching the material over a die. The load is applied to the edges of the sheet material tangentially to the edge of the forming die. The jaws of the hydraulic jacks that exert the force are made to the contour required in the transverse way of the panel, thus forming the edges of the panel and eliminating waste.

Surface Finish Measurement Instrumentation. II. James A. Broadston. *Instruments*, Vol. 20, No. 6, June, 1947, pp. 570–572, illus.

A survey of instruments for comparing surface finishes. The followers of such devices must accommodate to variations in the surface so minute that it is seldom possible to reproduce identical readings on two like instruments. The multiplicity of materials and types of finish further complicates the problem of applying instrumentation. A number of surface finish comparison sets are described which are used in industry for visual and tactile judgment of the standard of finish.

Considerations Involved in the Accurate Development of Templates. II. A. Dickason. *Sheet Metal Industries*, Vol. 24, No. 242, June, 1947, pp. 1193–1195, 1201, diagrs. Detailed calculations are given for developing a pattern for a flanged hole $2^1/_4$ in. in diameter.

Spot Welding of Some Aluminum and Magnesium Alloys. H. Brooks. *Sheet Metal Industries*, Vol. 24, No. 243, July, 1947, pp. 1436–1440, 1442, tables. 4 references.

A summary of a number of reports on investigations carried out by members of the LR.1 Committee of the British Welding Research Association. The reports show in a general way how welding characteristics vary with the compositions and properties of the alloys concerned. The alloys investigated include two nonheat-treatable aluminum-base alloys, an aluminum-coated duralumin alloy, and two magnesium-base alloys.

Methods of Surface Preparation of Light Alloys for Spot Welding. F. C. Dowding. *Sheet Metal Industries*, Vol. 24, No. 242, June, 1947, pp. 1232–1236, 1238, figs. 3 references.

Contact Arc-Welding. P. C. van der Willigen. *Philips Technical Review*, Vol. 8, No. 6, June, 1947, pp. 161–166, illus. (Cf. AER 9/47:59.)

Metallurgical Topics. *The Engineer*, Vol. 183, No. 4770, June 27, 1947, pp. 562, 563, diagrs. 5 references.

An extended abstract of a paper read by Dr. Hermann Kaestner before the Verein Deutscher Eisenhüttenleute in 1944. The use of a continuous casting process, such as is used in light-metal casting would, when applied to steel, results in a scrap reduction sufficient to make the process economical.

Convair 240. G. F. Gerhauser. *Aircraft Production*, Vol. 9, No. 102, July, 1947, pp. 258–264, illus. (Cf. AER 8/47:51.)

Small Sections Contoured by Preform Rolling. C. R. Wulfsohn. *The Iron Age*, Vol. 159, No. 26, June 26, 1947, pp. 54–57, illus.

The Preform Roll Process developed by the Douglas Aircraft Company, Inc., accomplished the forming of extrusions and sheet-metal stock into shapes requiring compound curvatures, contours, and reverse contours in a single operation without the use of dies. The material to be formed is propelled through rolls with molds that guide and protect it and control the contours and shapes of the finished product.

Profile Turning: Production of Small Repetition Parts by "Skiving." N. Cooke. *Aircraft Production*, Vol. 9, No. 105, July, 1947, pp. 249–251, diagrs. (Cf. AER 7/47:57.)

Friction-Cutting Techniques. H. J. Chamberland. *Aero Digest*, Vol. 55, No. 1, July, 1947, pp. 46, 47, 94, illus. A survey of the technique and applications of friction sawing for the cutting of sheet metals and pipe used in aircraft construction.

Use of Silver Alloys in Brazing. H. A. Smith and P. A. Koerner. *Aero Digest*, Vol. 55, No. 1, July, 1947, pp. 54–56, 87, illus.

A detailed discussion of the design specifications developed by Beech Aircraft Corporation for brazed silver-alloy joints. The specifications embody minute requirements for design, procedure, inspection, and final characteristics in order to ensure in production the reproducibility of a joint of adequate strength.

Japanese Methods of High Frequency Induction Heating and Melting. U.S., Naval Technical Mission to Japan. *Gt. Brit., British Intelligence Objectives Sub-Committee, Report No. B.I.O.S./J.A.P./P.R./760*, December, 1945. 19 pp., diagr. British Information Services, New York. $0.75.

Propellers

Wind Tunnel Tests of Airscrews with Various Numbers of Blades (Undersökning av Propellrar med Olika Bladantal). O. Holme. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 16 (FFA-Rapport AE-67)*, 1946. 25 pp., illus. Kr 3:–. (In Swedish.)

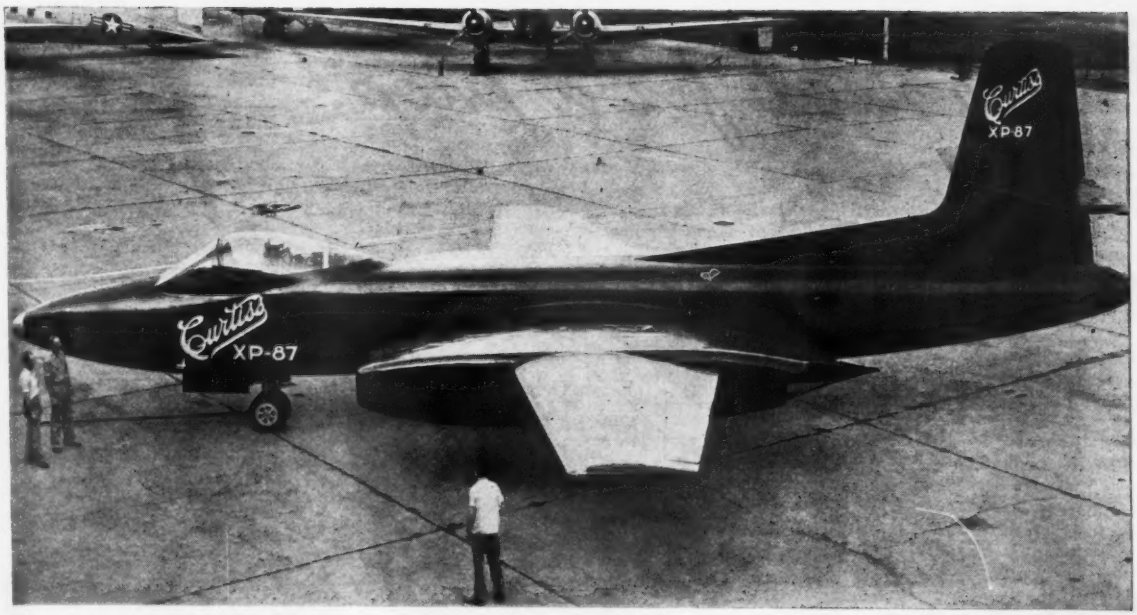
An investigation was made to find the aerodynamic characteristics of five propellers with the same blade form, rotating in front of an engine nacelle. Four of them were single propellers with two, three, four, and six blades, while the fifth consisted of two counterrotating propellers with three blades each. The single propellers were tested at blade angles of 30°, 40°, 50°, and 60° at 0.75 radius, and the counterrotating propellers were tested at the same angles on the forward propeller in combination with 5° less, the same, and 5° more on the rear propeller. The results of the investigation are given in the form of nondimensional coefficients of thrust, power, and propulsive efficiency.

Calculations of the Influence of Tip Speed on Airscrew Efficiency at High Speed Ratios v/u (Beräkning av Propellerverkningsgradens Beroende av Spetshastigheten vid Höga Hastighetsförhaallanden v/u). E. Petersohn and O. Holme. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 15, (FFA-Rapport AE-36)*, 1946. 11 pp., figs. Kr. 1:50. (In Swedish.)

The reduction of propeller efficiency at high tip speeds and high values of the ratio of forward to peripheral speed has been calculated from airfoil tests at high speeds and on the basis of data obtained from investigations of propellers at high tip speeds but at low values of forward to peripheral-speed ratio. Both methods show that the reduction of efficiency at a given tip speed is greater for higher values of this ratio. The reduction in efficiency calculated on the basis of the propeller tests is given in a large-scale table intended for use in propeller calculations. The effect of blade thickness on the reduction of efficiency can be taken into consideration by using, instead of the true value, an "effective" Mach Number that can be obtained by multiplying the true value by a factor that is a function of the relative blade thickness.

Comparison of Sound Emission from Two-Blade, Four-Blade and Seven-Blade Propellers. Chester W. Hicks and Harvey E. Hubbard. *U.S., N.A.C.A., Technical Note No. 1354*, July, 1947. 34 pp., illus. 7 references.

In order to check the applicability to fan-type propellers of the Gutin sound pressure emission theory and to investigate the loudness of propeller noises as heard by the ear, two-, four-, and seven-bladed propellers were tested under static conditions in the tip Mach Number range of 0.3 to 0.9. At a constant pitch se



The Curtiss XP-87, powered by four Westinghouse jet engines, is now ready to begin ground and taxi tests at Columbus, Ohio, plant of Curtiss-Wright Corporation before delivery to the Army Air Forces.

ting, the sound pressure in decibels for a given propeller shows an approximately linear variation with the tip speed of the propeller in the range of Mach Numbers tested. The Gutin theory is adequate for the prediction of total sound pressures in that Mach Number range where rotational noise is strong compared with vortex noises. Because vortex noise is a large part of the total noise at low tip Mach Numbers, especially for multiblade propellers, Gutin's formula will be inaccurate for these conditions. In general, the lower frequencies of sound tend to have greater attenuation in loudness with distance than the higher ones. Hence, under similar conditions a seven-bladed propeller is only slightly less loud than a two-bladed propeller at a distance greater than 400 ft.

Propeller-Loudness Charts for Light Airplanes. Harvey H. Hubbard and Arthur A. Regier. *U.S., N.A.C.A., Technical Note No. 1358*, July, 1947. 66 pp., figs. 9 references.

Calculations were made of the rotational-noise and vortex-noise loudness levels of propellers in forward flight of 50 to 200 m.p.h. at distances of 300 and 1,000 ft. Two-, four-, six-, and eight-bladed propellers were used with diameters of 6, 8, and 10 ft. They rotated at speeds between 1,000 and 3,000 r.p.m. An estimate of the vortex noise is given for all propellers considered. The loudness level is calculated according to the method of Fletcher and Munson for a large number of propellers in the light-airplane range and this information is given in chart form. From these charts the rotational-loudness level, the vortex-loudness level, and the resultant loudness level may be obtained directly.

Test of Four Full-Scale Propellers to Determine the Effect of Trailing-Edge Extensions on Propeller Aerodynamic Characteristics. Julian D. Maynard and Albert J. Evans. *U.S., N.A.C.A., Memorandum Report No. L5G10 (Wartime Report No. L-582)*, July, 1945. 60 pp., illus. 8 references.

Effect of Propeller-Axis Angle of Attack on Thrust Distribution over the Propeller Disk in Relation to Wake-Survey Measurement of Thrust. Robert E. Pendley. *U.S., N.A.C.A., Advance Restricted Report No. L5J02b (Wartime Report No. L-517)*, October, 1945. 32 pp., illus. 6 references.

Comparison of Flight Test Determinations of Power Absorption with Airscrew Strip Theory. R. C. Pankhurst, and E. M. Love. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2087*, November, 1945. 24 pp., figs. 10 references.

New Aircraft and Engine Designs Pose Unusual Vibration Problems. *Aviation Week*, Vol. 47, No. 3, July 21, 1947, p. 36, 4 figs.

Trends in airplane design are increasing the importance of first order propeller excitation. The periodic variation in lift of the propeller blades, which exists when the thrust line forms an angle with the air stream, can set up additional vibratory stresses that may exceed the design limits of a propeller.

An Experimental Investigation of the Effect of Propellers Used as Aerodynamic Brakes on Stability and Control. Victor I. Stevens, George B. McCullough, and Frederick H. Hanson. *U.S., N.A.C.A., Advance Restricted Report No. 5C01 (Wartime Report No. A-19)*, July, 1945. 99 pp., illus. 2 references.

Characteristics of Several Single- and Dual-Rotating Propellers in Negative Thrust. W. H. Gray and Jean Gilman, Jr. *U.S., N.A.C.A., Memorandum Report No. L5C07 (Wartime Report No. L-634)*, March, 1945. 100 pp., illus. 7 references.

German Variable-Pitch Propeller Mechanisms: A Report on the Characteristic Features of the V.D.M., Junkers, and Argus Types. S. Grott. *Aircraft Engineering*, Vol. 19, No. 220, June, 1947, pp. 184–189, 196, illus.

In the V.D.M. design the pitch-changing energy is transmitted by either a flexible shaft or a spur gearing to a gear system in the propeller hub. The hub of the Junkers propeller contains an integral hydraulic motor that provides for automatic pitch control only. The Argus pitch change drive operates from an air-driven vaned spinner that rotates with respect to the hub. The control is either mechanical or hydraulic. The text is illustrated with cutaway drawings, diagrams, and pictures of components disassembled.

Radio and Electronics

The Theory and Application of the Radar Beacon. Ralph T. Hultgren and Ludlow B. Hallman, Jr. *Institute of Radio Engineers, Proceedings*, Vol. 35, No. 7, July, 1947, pp. 716–730, illus.

Part I discusses the general theory underlying the operation of radar beacons. The various components of a typical beacon, such as receiver, discriminator, blanking gate, coder, modulator-driver, modulator, transmitter, stabilizing tuner, antenna, and monitor, are discussed in some detail. System considerations are discussed, such as the comparison of primary and secondary radar systems, delay in the beacon, factors governing the choice of beacon transmitter and receiver frequencies, system accuracy, duty cycle and traffic-handling capacity, and siting and range. Part II considers the application of the radar beacon to identification, air and ground-controlled general navigation, air and ground-controlled precision navigation, collision warning, emergency rescue, field-strength measurement, and airport-approach control.

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Survey of Radio Navigational Aids. Robert I. Colin. *Electrical Communication*, Vol. 24, No. 2, June, 1947, pp. 219–261.

Drift Determination with Radar, Using a Pulse-Doppler-Beat Method. Ivan A. Greenwood. *Navigation*, Vol. 1, No. 6, June, 1947, pp. 129–134, illus.

With this simple radar adaptation, the APA-46 "Nosmo," it is possible under ideal conditions to obtain drift determinations with an error of 1/8° in a time of about 20 sec. per observation. In mountainous terrain, however, drift errors of 4° have been reported. The system does not function over water and its operation may not be satisfactory over very dry and very flat ground.

Radio Navigation Method "Egon." W. Falta. (*EIS/S/CO/25*, December, 1942–February, 1944.) *U.S., Army Air Forces, Translation No. F-TS-2634-RE*, June, 1947. 31 pp., diagrs.

The ground control of the course of the aircraft is accomplished by a radar identification signal transmitted from the airplane and intercepted by a ground station. Plotting, navigation, course correction, and fire control are done at the ground station and transmitted to the pilot by U.H.F. radio. The range of accuracy is about ± 200 m. and the azimuth accuracy about ± 0.3°.

Standardizing Radio Navigation Systems. Dudley Saward and J. A. Richards. *The Aeroplane*, Vol. 72, No. 1880, June 20, 1947, pp. 660–662, illus. A comparison of the advantages of the V.H.F. Omnirange and the Gee systems.

Electric Equipment. Peschelt, Heil, and Weinbrand. (*EIS/Tel/44–45.*) *U.S., Army Air Forces, Translation No. F-TS-3031-RE*, June, 1947. 14 pp., diagrs.

Descriptions of two circuit testing devices, designed by Arado Flugzeugwerke and by Televonbau, and consisting entirely of standard telephonic system components. Each instrument can accommodate 100 circuits and test for continuity, shorts, grounds, and cable insulation.

Confocal Ellipsoidal Shells as Electromagnetic Cavity Resonators. Geppert and Schmid. (*Berlin, Universität, Mathematiches Institut, ZWB/UM/763*, May, 1944.) *U.S., Army Air Forces, Translation No. F-TS-1086-RE*, June, 1947. 57 pp., figs. 14 references.

The wave length of the basic electric oscillation of a cavity resonator formed by two confocal flattened rotary ellipsoids is expressed as a function of the shell thickness and its eccentricity. The formula of the electromagnetic field of these oscillations is given in a numerical form that may be used directly.

Rotating Wing Aircraft

Motion of an Unarticulated Helicopter Blade. Jonathan Winson. *Journal of the Aeronautical Sciences*, Vol. 14, No. 9, September, 1947, pp. 520–526, figs. 8 references.

Rigid rotor vibration is analyzed by investigating the bending oscillation, perpendicular to the plane of rotation, of the unarticulated helicopter blade. Two differential equations of motion are written in terms of two of the natural modes of the blades. The solutions of the equations are a pair of infinite Fourier series in terms of the position of the blade in azimuth. The series are approximated by their constant and first harmonic terms. Six simultaneous linear algebraic equations written in terms of flight and blade parameters give the six Fourier coefficients. A sample problem is carried through beginning with the physical characteristics of a blade and yielding the bending motion at a specific flight condition. The method can be extended to include a larger number of natural modes and to achieve a closer approximation to the infinite series solutions. A sufficient number of variables are included to describe blades of current design.

Rotor Blade Flapping Motion. Gabriel Horvay. *Quarterly of Applied Mathematics*, Vol. 5, No. 2, July, 1947, pp. 149–167, figs.

A method developed for the solution of a class of Hill differential equations is applied to solve the differential equation of flapping motion of helicopter rotor blades. The stability of blade flapping motion is established for the range of numerical parameters that usually arise in helicopter theory. The stability of the equation for large values of the ratio of forward velocity to blade tip speed, and the possibility of resonance are investigated.

Investigation of a Helicopter Model; 3rd Progress Report. H. G. Küssner. (*ZWB/FB/523/3*, July 15, 1937.) *Cornell Aeronautical Laboratory*, May,1947. 52 pp., illus.

A measurement setup is described which was designed to obtain, at the sacrifice of some accuracy, high-speed remote indication of wind-tunnel data from helicopter models. In addition to the six-component measurements, the hinge moment, total lift, total drag, side force, pitching moment, and rolling moment of the rotor were obtained. The tests were made to discover which data required further full-scale investigation.

Helicopter Testing Towers Stress Blades. *Aviation Week*, Vol. 47, No. 1, July 7, 1947, p. 21 (illus. p. 14).

The testing tower built by the N.A.C.A. to test helicopter rotors out of range of ground effect is 40 ft. high and has been in operation since October, 1946. It is powered by a 1,500-hp. Packard marine engine geared to turn the rotor at 80 to 400 r.p.m. A similar tower built in England is flexibly mounted and restrained by six guy-ropes. Altering the tension of the ropes imparts to the rotor oscillations simulating those found in present helicopters.

Full-Scale Helicopter Rotor Test Tower. *Aero Digest*, Vol. 55, No. 1, July, 1947, p. 38, illus. (Cf. AER 7/47:65.)

Description of a full-scale rotor test tower, similar to the N.A.C.A. tower at Langley Field. Being built by the Bristol Aeroplane Co., in Filton, England, it will accommodate a 60-ft. rotor.

Helicopter Wind Tunnel Tests. Robert S. Ross. *American Helicopter*, Vol. 7, No. 8, July, 1947, pp. 6, 7, 22, illus. A discussion on the value of using models for helicopter research.

Notes on the Manufacture of Helicopter Transmissions. F. T. Griswold, Jr. *American Helicopter*, Vol. 7, No. 8, July, 1947, pp. 20, 27, illus.

Largest AAF Helicopter Flies; Points to Commercial Trend. Alexander McSurely. *Aviation Week*, Vol. 47, No. 2, pp. 11, 12, illus.

The XR-10, built for the U.S. Army Air Forces by Kellett Aircraft Corporation, is a twin-engined transport-type helicopter. Two 525-hp. Continental engines drive two counterrotating, intermeshing, three-bladed rotors of 65 ft. diameter. The XR-10 can carry a crew of two and ten passengers or 2,000 lbs. of cargo. Maximum speed is over 100 m.p.h.; range, almost 350 miles.

Model 100 Helicopter. *Aero Digest*, Vol. 55, No. 1, July, 1947, p. 39, illus.

The Helicopter Engineering and Construction Corporation Model 100, now being ground-tested, is a single-place helicopter with a 75-hp. Continental engine driving a single main rotor and a tail rotor. Design gross weight is 750 lbs.

The LePage Rotor Prop. George Wales. *American Helicopter*, Vol. 7, No. 8, July, 1947, p. 14, illus.

An aircraft proposed by W. Lawrence LePage. Wing tips would terminate in propeller hubs that could operate on vertical or horizontal axes. The aircraft would be capable of vertical ascent, however, and autogyration. With the hubs operating on horizontal axes, conventional forward speeds could be attained.

Hiller Simplifies Design to Cut 'Copter Production Costs. *Aviation Week*, Vol. 47, No. 1, July 7, 1947, p. 29, illus.

The Commuter, a two-place experimental craft being tested by United Helicopters, Inc., employs two coaxial rotors. The engine is cooled by a downdraft fan drawing air through ducts in the forward section of the rotor-base housing. A simplified coupling permits removal of the tail cone for engine servicing.

Notes from Helicopter School. II—On Learning to Fly This New Aircraft. Wolfgang Langwiesche. *Air Facts*, Vol. 10, No. 7, July 1, 1947, pp. 63–78, diagrs.

Seaplanes and Flying Boats

An Investigation of Effects of Reversed-Type Longitudinal Steps on Resistance and Spray Characteristics of a Flying-Boat Hull. Arthur W. Carter, Eugene P. Clement, and Alvin H. Morewitz. *U.S., N.A.C.A., Technical Note No. 1356*, July, 1947. 17 pp., illus. 6 references.

Application of reversed-type longitudinal steps to the forebody of a model of a conventional flying-boat hull effected no appreciable improvement in resistance or spray characteristics near the hump speed. At the higher planing speeds, however, the use of the steps made a small improvement in the resistance of the hull. The height of the spray was appreciably reduced by decreasing the lateral flow of the spray and directing it aft. Since favorable results were obtained only at high speeds, in any practical application the extent of the reversed-type longitudinal steps need be only about one beam forward of the transverse step.

A Theoretical Investigation of Hydrodynamic Impact Loads on Scalloped-Bottom Seaplanes and Comparisons with Experiment. Benjamin Milwitzky. *U.S., N.A.C.A., Technical Note No. 1363*, July, 1947. 50 pp., figs. 6 references.

It is assumed that the primary flow experienced upon impact by scalloped-bottom seaplanes occurs in transverse planes and that the virtual mass in any flow plane is determined by the modified section characteristics. This assumption is made on the basis of an analysis that gives a fairly good representation of the load-time variation during immersion for vertical impacts at zero trim and for the more general case of impacts at positive trim along flight paths inclined to the keel and the water surface. This analysis may be applied to impacts in rough water if the initial conditions are taken relative to the wave slope.

Effect of Aerodynamic Refinement on the Aerodynamic Characteristics of a Flying-Boat Hull. John M. Riebe and Rodger L. Naeseth. *U.S., N.A.C.A., Technical Note No. 1307*, June, 1947. 28 pp., illus. 2 references.

The reduction in drag obtained by completely fairing out the chines, chine flares, and the step in the keel appears to justify completely the incorporation of retractable steps and chines to retain hydrodynamic performance of the conventional-type flying boat hull.

Stress Analysis and Structures

Face Buckling and Core Strength Requirements in Sandwich Construction. Conrad C. Wan. *Journal of the Aeronautical Sciences*, Vol. 14, No. 9, September, 1947, pp. 531–539, figs.

A study of the strength requirements of core materials in sandwich construction. From consideration of the effect of initial waviness in the facings of sandwiches, a rational relation has been established between the ultimate core strength, the core modulus, and the wrinkling stress of the facings. A numerical constant is introduced as a measure of the waviness of the facings which, for sandwiches with aluminum-alloy faces and end-grain balsa, as made with present production technique, has been found to lie between 0.01 and 0.02. Charts are given for sandwiches with 24S-T81 Alclad and 75ST Alclad facings and end-grain balsa core which can be used to establish strength requirements for core materials.

The Analysis of a Circular Ring with Propped Floor Beam. J. S. Taylor and S. S. Gill. *College of Technology, Manchester, England.* (For abstract see "I.A.S. Briefs" on page 24 of this issue, October, 1947.)

The Theory of Limit Design Applied to Magnesium Alloy and Aluminum Alloy Structures. Filadelfo Panlilio. *Royal Aeronautical Society, Journal*, Vol. 51, No. 438, June, 1947, pp. 534–571, figs. 22 references.

The simplified methods of limit design that have been developed for specific application to steel structures take into account the fact that the value of the limit of elasticity of a redundant structure is less than the value of the maximum load that can be sustained before failure. Light metal specimens were tested to demonstrate that their load-deformation diagram is similar to their stress-strain curve and that, because of this property, the redundant-plus-one sections in a beam never equalize moments within reasonable limits of deformation. A second series of tests was conducted (1) to show that the elastic limit stress is an extremely inadequate criterion of the strength of a redundant structure in alloys of magnesium and aluminum and (2) to demonstrate that the absence of the well-defined condition of yielding which is a characteristic of these metals is advantageous. The absence of this condition is advantageous because the increase in load factor provided by redundant structures is greater for light metals than for steel. Test results showed that the methods of limit design can be applied with safety to structures made of alloys of magnesium and of aluminum as long as a suitable arbitrary value is selected for the maximum allowable deformation.

Deformation Analysis of Wing Structure. Paul Kuhn. *U.S., N.A.C.A., Technical Note No. 1361*, July, 1947. 43 pp., diagrs. 8 references.

A comparison of elementary theories of bending and torsion with the more refined stress theories which have been developed shows that the deflection corrections are small. Simple approximation formulas are proposed which are adequate for design purposes when conventional structures under reasonably uniform loading are being considered.

A Certain System of Functions and Its Applications to the Theory of Elasticity (Ob Odnoi Sisteme Funktsii i ee Prilozheniiakh v Teorii Uprugosti). M. M. Filonenko-Borodich. *Prikladnaia Matematika i Mekhanika* (Moscow), Vol. 10, No. 1, 1946, pp. 193–208, figs. (In Russian.)

An "almost orthogonal" system of functions is applied to the bending of a beam with both ends clamped and to the stress distribution in a rectangular plate with loads applied along the edges in the plane of the plate.

Determination of the Fatigue Life with Stress Cycles of Varying Amplitude (Bestämning Livslängden vid Utmattningsprov med Variabla Lastgränser). S. Luthander and G. Waallgren. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 18 (FFA-Rapport HE-86)*, 1946. 23 pp., figs. 16 references. Kr. 2:50. (In Swedish.)

A method of calculating the length of life of a structure that is subjected to fatigue loading with variable load limits. The method has as a requisite the fatigue diagram of the structure or test specimens as obtained for fixed limits of stress. The results obtained with specimens of Alclad sheet agreed reasonably with the calculations.

A—The Stresses and Deflection of a Plate Having the Shape of the Sector of a Circular Disc with a Central Hole, Subjected to an Arbitrarily Distributed Loading and Freely Supported Along the Straight Edges (Spänning och Deformation hos en Platta i Form ave en Cirkelsektorring, Aaverkad av Godtyckligt Fördelad Tvärbelastning och Fritt Upplagd Langs de Raka Kanterna). B—An Investigation of the Stress Distribution on a Spherical Triangular Shell with Rectangular Corners When Subjected to an Evenly Distributed Loading on the Surface (Stadium av Spänningsfördelningen i ett Sfäriskt, Triangulärt Skal Med Räta Hörnvinklar, Belastat Med Jämnt Fördelad Ytbelastning). S. Sjöström. *Sweden, Flygekniska Försöksönstalten, Stockholm, Meddelande Nr. 19 (FFA-Rapport HE-118:1, 2)*, 1946. 34 pp., Illus. Kr. 3:50. (In Swedish.)

A. An investigation of the stresses and deformation of a flat plate bounded by arcs of two concentric circles and radii of these circles. A general solution for the deflection of the plate is obtained for the case when the straight edges are supported freely, the circular edges have arbitrary boundary conditions, and the load distribution normal to the surface is also arbitrary. A solution is developed for the particular case of the quadrant of a circle with notch at the center. All edges are simply supported, and an evenly or parabolically distributed load is applied. As an experimental check of the method of calculation the distribution of stress was measured along the bisector of a plexiglass plate in the form of the quadrant of a circle. The edges were supported as freely as possible and the plate was subjected to an evenly distributed loading normal to the surface. The agreement between the theoretical and empirical results is satisfactory.

B. An investigation of the stress distribution along the bisector of a spherical triangular shell with rectangular corners (the eighth part of a sphere) when subjected to hydrostatic pressure. The boundary conditions of the edges of the shell signify that all components of deflection are zero and that there are no fixing moments. The stress distribution is determined experimentally, and the laws of similarity that apply when the ratio between the radius of the sphere and the thickness of the shell is changed are analyzed.

Calculation of the Stresses in a Circular Plate Supported by Two Concentric Rings and Stressed by a Uniform Transverse Load (Beräkning av Paakänning i en paa tvaa Koncentriska Ringstöd Upplagd Cirkulär Platta, Aaverkad av Likformigt Fördelad Tvärbelastning). S. Luthander and S. Sjöström. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 6 (FFA-Rapport HE-107)*, 1944. 14 pp., figs. Kr. 1:50. (In Swedish.)

A determination of the radial and circumferential stresses and the ideal stresses in a thin circular plate according to the deviation energy hypothesis. The equation for the displacement of the plate has an elementary solution. If the stress distribution is presumed to be linear along a normal to the plate, the relation between the stresses and the transverse displacement can be found from the expressions for the radial and circumferential moments and the shear force. Since there are two supports, the calculation of the integrating constants is statically indeterminate and is solved in a general way by using the boundary and the continuity conditions of the plate. The functions of the stresses

are computed, and values of the stresses are found by substituting various values of the radius. Different values of the ratios of the two radii of the supports to the outer radius of the plate have been taken as parameters in order to express all radii nondimensionally.

Critical Shear Stress of Long Plates with Transverse Curvature. S. B. Batdorf, Murry Schildcrout, and Manuel Stein. *U.S., N.A.C.A., Technical Note No. 1346*, June, 1947. 23 pp., figs. 5 references.

A theoretical solution for the buckling stress of long plates with transverse curvature loaded in shear. The calculations amplify the treatment already given by Leggett and Kromm. The results are given in the form of curves and formulas for a wide range of plate dimensions for plates with simple supported or clamped edges. Because of the additional restraint imposed upon the plate in Leggett's solution, his results for plates with simply supported edges are considerably higher than those in this paper, which are identical with those of Kromm. For plates with clamped edges all solutions are in approximate agreement with those of Leggett in the low curvature range to which Leggett's results are restricted.

Design Mechanics of Thin Elastic Plates (Stroitel'naia Mekhanika Uprugikh Tonkikh Plastinok). V. Z. Vlasov. *Prikladnaia Matematika i Mekhanika* (Moscow), Vol. 10, No. 1, 1946, pp. 173–192, figs. 7 references. (In Russian.)

Two-dimensional problems of the theory of elasticity for rectangular thin plates can be solved by reducing the partial differential equations to ordinary differential equations. Plates and deformed prismatic shells are analyzed and the results are applied to a generalization of the elementary problems of resistance of materials. The equation for a deformed plate is integrated by application of Cauchy-Krylov method for the bending of a beam on an elastic foundation. Formulas are presented for the stability of a long rectangular plate and for the stability and deformation of a thin-walled channel section.

The Method of Initial Parameters in Problems of Plates and Shells of Rotation (O Metode Nachal'nykh Parametrov v Zadachakh Vrashcheniia). B. G. Korenev. *Prikladnaia Matematika i Mekhanika* (Moscow), Vol. 10, No. 1, 1946, pp. 165–172. 11 references. (In Russian.)

A. N. Krylov's method for one-dimensional elastic problems is extended to the analysis of a circular plate, on an elastic foundation with a central symmetric load, and to the analysis of the axially symmetric deformation of a round conical shell. Results are compared with those obtained by earlier methods.

Lower Buckling Load in the Non-Linear Buckling Theory of Thin Shells. Hsue-Shen Tsien. *Quarterly of Applied Mathematics*, Vol. 5, No. 2, July, 1947, pp. 236, 237, figs.

An amplification of "A Theory for the Buckling of Thin Shells" published in the JOURNAL OF THE AERONAUTICAL SCIENCES (Vol. 9, No. 10, August, 1942). If the external excitation is sufficiently large, a buckling point lower than that proposed will make its appearance. Between this lower point and that previously established, buckling will absorb energy rather than release energy, as is the case after the higher point has been reached.

Problems Concerning Cylindrical Shells Solved by Means of the Residuum Principle (Lösning av Cyclinder-problem med Hjälp av Hakintegraler). S. Sjöström. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 10 (FFA-Rapport HE-183)*, 1945. 23 pp., figs. Kr. 2:50. (In Swedish.)

The problems of stresses and deformation in thin cylindrical shells with arbitrary loading normal to the surface. The thin shell is bounded by two circular arcs joined by straight lines parallel to the axis of the cylinder. The boundary conditions along the two straight edges can be chosen arbitrarily. The components of deflection, radially and tangentially, and the component of moment in the tangential direction are all zero along the circular edges. If the boundary conditions are given along the circular edges instead, they are expressed here in the form of equilibrium of forces for each part-loading of which the load expression consists. Beginning with three partial, linear, and nonhomogeneous differential equations for the three components of deflection of the middle surface of the shell, it is possible to find approximate functions for the deflections. These are complex integrals that can be solved by means of the residuum principle. Compound loading can be dealt with by combining the elementary loading cases.

Some Investigations of the General Instability of Stiffened Metal Cylinders. VIII—Stiffened Metal Cylinders Subjected to Pure Torsion. Louis G. Dunn. *U.S., N.A.C.A., Technical Note No. 1197*, May, 1947. 52 pp., illus. 9 references.

Under a combined loading of bending and torsion the ultimate load of the stiffened cylinder is dependent on the ratio of the shearing stress at failure for combined loading to the shearing stress at failure for pure torsion. Since the buckling problem of stiffened cylinders is nonlinear, it has not been treated theoretically. An analysis of the spacing and sectional properties of the stiffening elements, the wall thickness, and the diameter of the cylinder led to a suitable parameter for estimating the general-instability stress of reinforced metal cylinders when subjected to pure torsion loading.

Stresses in and General Instability of Monocoque Cylinders with Cutouts. III—Calculation of the Buckling Load of Cylinders with Symmetrical Cutout Subjected to Pure Bending. N. J. Hoff, Bruno A. Boley, and Bertram Klein. *U.S., N.A.C.A., Technical Note No. 1263*, May, 1947. 31 pp., figs. 14 references.

A strain-energy theory is developed for the calculation of the buckling load in pure bending of reinforced monocoque cylinders that have a symmetrical cutout on the compression side and which buckle according to the general instability pattern. The theoretical curve obtained is similar in shape to that obtained experimentally, but the theoretical values were consistently too high. The greatest deviation observed was 39.3 per cent.

Critical Stress of Thin-Walled Cylinders in Axial Compression. S. B. Batdorf, Murry Schildcrout, and Manuel Stein. *U.S., N.A.C.A., Technical Note No. 1343*, June, 1947. 21 pp., figs. 15 references.

Available test data on critical stresses of cylinders are reexamined. The data are plotted in terms of the parameters of cylinder theory and are compared with theoretical results derived on the basis of small-deflection theory. The use of the theoretical parameters and the theoretical solutions as a guide in fairing the curves permits the removal of the lower limits in these curves. Estimated curves can also be drawn for the buckling stresses of simply supported cylinders, although experimental data are available only for cylinders with clamped edges.

Strength Tests of Thin-Wall Truncated Cones of Circular Section. Eugene E. Lundquist and Evan H. Schuette. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-442)*, December, 1942. 26 pp., illus. 6 references.

Torsion of a Circular Tube with Longitudinal Circular Holes. Chih-Bing Ling. *Quarterly of Applied Mathematics*, Vol. 5, No. 2, July, 1947, pp. 168–181, figs.

A solution of St. Venant's torsion problem of a circular tube having a ring of uniformly distributed longitudinal circular holes of equal radii. The solution is found by constructing three series of harmonic functions that are invariant with respect to rotation about the axis of the tube. The parametric coefficients attached to these functions are determined so as to satisfy the required boundary conditions. Several numerical examples are used to illustrate the solution.

Combined-Stress Tests on 24S-T Aluminum-Alloy Tubes W. R. Osgood. *Journal of Applied Mechanics*, Vol. 14, No. 2, June, 1947, pp. A-147, illus.

Tubes of $1^3/_4$-in. inside diameter with 0.05-in. walls were tested to failure. The results are presented as a set of stress-strain curves for the maximum shearing stress plotted against the maximum shearing strain and the octahedral shearing stress plotted against octahedral shearing strain.

Strength Analysis of Stiffened Beam Webs. Paul Kuhn and James P. Peterson. *U.S., N.A.C.A., Technical Note No. 1364*, July, 1947. 60 pp., diagrs. 17 references.

A semiempirical engineering theory of incomplete diagonal tension, which is simplified by being confined to overall or average affects, is used as the basis of a method for strength analysis of stiffened shear webs. The theory is formulated in such a way that the limiting conditions of fully developed diagonal tension and of zero diagonal tension (so-called "shear-resistant web") are included. It can therefore be used to interpolate between these limiting conditions.

Elastic Oscillations with Damping Proportional to an Arbitrary Power of the Velocity (Ob Uprugikh Kolebaniakh pri Soprotivlenii, Proportsional'noi Proizvol'noi Stepeni Skorosti). I. M. Volk. *Prikladnaia Matematika i Mekhanika* (Moscow), Vol. 10, No. 1, 1946, pp. 125–134. (In Russian.)

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where p, q, n, and a are certain positive constant values and dx/dt is designated by $\dot{x}$.

Transverse Vibrations of Bars and Fatigue Fractures. I. P. Matthieu. (*Schweizer Archiv*, Vol. 12, Nos. 11, 12, November, December, 1946, pp. 329–338; 361–372.) *The Engineers' Digest*, Vol. 4, No. 6, June, 1947, pp. 273–277, illus.

In an attempt to explain fractures of propeller blades and turbine wheels which occurred at unexpected places, as at the outer ends of blades, a mathematical analysis is developed for the dynamic stresses that arise in a cylindrical bar, fixed at one end and forcibly oscillated by harmonic translation and harmonic rotation at the point of fixture. The periodic motions are of equal frequency but are not in resonance with any natural harmonic frequency of the bar. The maximum amplitude nearest to the free end of the bar converges rapidly toward the free end itself, and the maximum amplitude nearest the fixed end converges rapidly toward the point of fixture. In free harmonic vibrations, the largest amplitude of vibration occurs at the free end of the bar and the corresponding stress wave has its largest amplitude at the fixed end. If a bar vibrates with a natural or nearly natural frequency, any overstress will cause fracture at the fixed end only. If nonharmonic periodic motion is applied to the point of fixture, the bar again may be caused to break at any chosen cross section, which in practice will be either near the free end or at the point of fixture.

Vibration Testing Technique and Its Use in Improving Designs. John A. Dickie. *Product Engineering*, Vol. 18, No. 7, July, 1947, pp. 115–119, illus. 7 references.

Vibration testing supplements static strength testing by determining the natural resonant modes of a structure and their relationship to exciting frequencies. Test equipment and procedures are described. Possible corrective design modifications are suggested in view of evaluations made of typical test results.

Generalized Vibration Analysis by Means of the Mechanical Transients Analyzer. G. D. McCann and J. M. Kopper. *Journal of Applied Mechanics*, Vol. 14, No. 2, June, 1947, pp. A-127–A-134, illus. 6 references.

A linear system having two degrees of freedom is described in terms of the mechanical parameters of translational motion. It consists of one mass-spring-dashpot system mounted on another. Three types of generalized solutions are given for the maximum motion of the first system relative to the second or the maximum stress developed in the spring of the first system.

Mechanical Testing. II—A Review of Methods of Structure-Loading. E. R. Arbon. *Aircraft Production*, Vol. 9, No. 102, July, 1947, pp. 267–269, illus. (Cf. AER 9/47:67.)

Techniques of testing structural strength are described, compared, and evaluated. The beam distribution system of load distribution, the electromagnetic attachment of loading points, deadweight loading, pneumatic and hydraulic loading, test rigs and their calibration, vibrator excitation, methods of applying repeated loading, and evaluation of test results are treated.

Brittle Lacquer Stress Analysis. I. E. Barber. *Engineering Materials*, Vol. 5, No. 17, June, 1947, pp. 59–61, diagrs.

The time required to design parts can be considerably reduced by applying a brittle lacquer to a prototype of the part, subjecting it to working conditions, observing the stress concentrations and modifying the part appropriately. A lacquer has been developed which will crack under extensions as small as 0.0004 in.

Stress Determination by Brittle Coatings. Greer Ellis. *Mechanical Engineering*, Vol. 69, No. 7, July, 1947, pp. 567–571, illus. 4 references.

A detailed description of the method and its application. Proper selection of the coating, control of conditions of temperature and humidity, and the use of etching dyes make it possible to obtain quantitative evolution of strains of extremely small magnitude.

Static Testing the Fairchild XNQ Trainer Prototype. Edwin T. McClanahan. *The Pegasus*, July, 1947, pp. 13–15, illus.

Some Basic Characteristics of Wire Strain Gauges and Bridge Circuits for These Gauges. Gotthard V. A. Gustafsson. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 22 (FFA Technical Note ME-34)*, 1947. 17 pp., diagrs. 13 references. Kr. 2:-. (In English.)

A basic survey of the calculation of strain and temperature sensitivity of a wire cemented to a surface and the factors that determine the sensitivity of wire strain gages. The assumption that the resistance of such a gage varies directly is demonstrated. The relation between strain, balance reading, and galvanometer deflection is investigated for two types of Wheatstone-bridge circuits.

A Device for Making Readings of Huggenberger Tensiometers at a Distance (Anordning för Fjärravläsning av Huggenberger Tensometer). S. Luthander and G. Gustafsson. *Sweden, Flygtekniska Försöksanstalten, Stockholm, Meddelande Nr. 3 (FFA-Rapport HE-60)*, 1944. 6 pp., illus. Kr. 1:-. (In Swedish.)

The scale of the tensiometer is replaced by a resistance. A current passing through the needle and the resistance forms one leg of a Wheatstone bridge. When the remote reading is taken, an electromagnet is activated which causes the needle to contact the resistance. The current through the needle is held constant by a separate variable resistance in series with the tensiometer. The variable resistance is controlled by a special ammeter. The millivoltmeter on which the readings are taken is mounted in an instrument box so wired that it is possible to take readings successively from ten tensiometers.

Wind Tunnels and Laboratories

Open-Circuit Wind Tunnel. Alan Pope. *Aero Digest*. Vol. 55, No. 1, July, 1947, pp. 74, 122, diagrs.

A comparison of the features of the open- and closed-circuit types of wind tunnels shows that the open-circuit wind tunnel has the advantage of being able to accommodate continuous testing of all types of engines without special provision for the removal of the exhaust. It is simpler and cheaper to construct than a tunnel of the closed-return type and can be designed so that its efficiency is better than that of closed-circuit type.

Tunnel Correction for Compressible Subsonic Flow. A. v Baranoff. (*ZWB/FB Nr. 1272*, July 5, 1940.) *U.S., N.A.C.A., Technical Memorandum No. 1162*, July, 1947. 25 pp., diagrs. 6 references.

N.P.L. Mach Number Gauge. D. Giles. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2131*, July, 1945. 4 pp., diagrs. 3 references. British Information Services, New York. $0.30.

The intake pressure and the static working pressure of a wind tunnel are applied to a balance beam on either side of the pivot. Suitable weights are provided to set the balance at any desired Mach Number and to allow for barometric pressure correction. Two iron plates mounted on the balance beam move in the field of the electromagnet component of an electrical balance indicator circuit which is read on a Weston a.c. differential dynamometer.

The Optical Investigation of Fluid Flow. R. Weller. *Journal of Applied Mechanics*, Vol. 14, No. 2, June, 1947, pp. A-103–A-107, illus.

The viscous shear in certain liquids gives rise to optical effects similar to those observed in the photoelastic analysis of stress systems. A method of calibrating this effect and applying it to a study of lamellar flow has been developed under the auspices of the N.A.C.A. The instruments and test procedures are described. Photographs illustrating typical results are analyzed.

The "China Clay" Method of Indicating Transition. E. J. Richards and F. H. Burstall. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2126*, August, 1945. 9 pp., illus. 5 references.

A rapid method of determining transition over the whole airplane or over an entire wing. A solid layer of china clay is sprayed on the surface to form a smooth, white, absorbent film. A liquid having the same refractive index is sprayed on this surface, making it transparent. Where the liquid has evaporated the white film will reappear. This will indicate differences in rate of evaporation and, consequently, the complete picture of the transition position over the whole body.

All-Weather Tests Speeded by New AAF Climatic Hangar. *Aviation Week*, Vol. 47, No. 3, July 21, 1947, p. 32.

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Books

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Mathematical Theory of Rocket Flight. J. Barkley Rosser, Robert R. Newton, and George L. Gross. New York, McGraw-Hill Book Co., Inc., 1947. 276 pp., figs., tables. $4.50.

Work on the ballistics of fin-stabilized rocket projectiles carried out at the Alleghany Ballistics Laboratory during 1944 and 1945 is described in this final report to the Office of Scientific Research and Development. Included is a considerable amount of expository material which was added to the report after the removal of secrecy restrictions. The volume represents a valuable contribution to the theoretical study of rockets in flight. During the course of the work, two simplifying devices for avoiding certain difficulties in the theory of rocket flight were discovered. The first makes use of some dynamical laws especially suited to rockets in deriving the equations of motion, and the second employs some mathematical functions especially suited to rockets in solving the equations of motion. A large part of the volume is devoted to the explanation and illustration of these devices, but some material not involving them is included for completeness. While intended especially for readers with scientific training, the authors have endeavored to make the volume understandable, for those who must avoid mathematics, by supplying simple explanations at the beginnings of most sections, telling what is to be accomplished in them. There are chapters on the equations of motion of a rocket, motion after and during burning, boundary conditions, and the properties of the rocket functions. Included in appendixes are a simplified theory of flow through a nozzle, the derivation of a principle for rotation of a rocket, minor factors affecting the flight of a rocket, functions for use with an unstable rocket, and functions for use with jet damping. There is a bibliography of 19 references and a glossary of symbols.

New Weapons for Air Warfare. Edited by Joseph C. Boyce. Boston, Little, Brown and Co., 1947. 292 pp., illus. $4.00.

The second of a series on the work of the Office of Scientific Research and Development and its subcommittee, the National Defense Research Council, this collection of descriptions of outstanding developments of World War II in the weapons of air warfare is so edited as to form a continuous historical study. The editor was Special Assistant to the Chairman of the N.D.R.C. for 5 years. Since this book avoids highly technical terminology and involved treatments and contains many references to the personnel and organizations that worked on the problems and produced the devices, it should be of interest to anyone desiring an overall picture of wartime development in the weapons of air warfare.

The first section of the book describes the development of the fire-control devices and systems which played such an important role in the successful outcome of the war. There is an excellent description of the T-10 electric director, developed through contract with the Bell Telephone Laboratories and standardized by the Army as the M-9, a device that was used sucessfully throughout the war and aided in solving the problem of the menace of V-bomb attacks against London. Proximity or influence fuses for detonating the explosive heads carried by missiles are discussed in the second part of the book. Emphasis is placed on the difficulties involved in achieving production and acceptance of the VT fuses. Fuses for rotating missiles, such as shells, and nonrotating missiles, such as bombs and rockets, are discussed. The final section of the book is devoted to the development of guided missiles. The general program and major accomplishments are summarized, and the development of several different missiles, such as Felix, Pelican, Bat, Roc, Azon, and Razon, is described in detail.

Construction des Avions (Construction of Airplanes). Guy du Merle. 2nd Ed. Paris, Dunod, 1947. 855 pp., illus. 2,350 fr.

The purpose of the author is to describe for the engineer the various methods of designing and constructing airplanes, with a minimum of mathematics. It is not intended to be a manual of calculations but to give an idea of the diversity of possible solutions, with examples, and to make known errors that must be avoided. The first two parts of the book deal with the construction of conventional airplanes and seaplanes by classical methods. The first part takes up the principal components from the point of view of their exterior configuration and deals with the topic of airplane utilization. In this section are included discussions of aerodynamics, performance, flight qualities, and ground performance. The second part considers structures, fabrication, installations, maintenance, safety, and weight specifications. In the third section special types of aircraft, such as the canard and the flying wing, and rotating wing aircraft are discussed. Special problems, such as icing, high altitude, reaction propulsion, assisted take-off, and gliders and glider towing, are examined here as well. A glossary and the text of French airworthiness regulations are included. A feature of the volume is the section of photographs and three-view drawings of more than 200 airplanes illustrative of the text. There is an index of these referring to both text and illustrative sections. The book is complete and thorough. The author brings a wide experience as an engineer, pilot, and teacher to the task he has set for himself and in which he has admirably succeeded.

Conduction of Heat in Solids. H. S. Carslaw and J. C. Jaeger. Oxford, at the Clarendon Press; New York, Oxford University Press, 1947. 386 pp., figs., tables. $8.00.

The present work is based on the authors' earlier book on the subject, *Introduction to the Mathematical Theory of the Conduction of Heat in Solids*, which was published in 1921. Because so many advances both in the theory and in the application of the subject have been made during the past 25 years, it was found necessary to rewrite the volume completely to bring it up to date. This task has been well carried out. Of particular importance and value is

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the thorough treatment of the Laplace transformation method of dealing with problems in the conduction of heat. In planning this volume the attempt has been made to make it as useful as possible to engineers and physicists without altering its character as a mathematical work. Explicit solutions to many problems of practical interest are included, and much numerical information in the form of tables and text-figures is given. The discussion of the theory of systems used in experimental work has been greatly extended. Other subjects of practical importance are briefly discussed, such as the theory of automatic temperature control, which heretofore has not been treated in mathematical texts. Over 400 references to the mathematical and physical aspects of the various topics provide an adequate introduction to the literature on the subject.

Radar System Engineering. Edited by Louis N. Ridenour. (M.I.T. Radiation Laboratory Series, Vol. I.) New York, McGraw-Hill Book Co., Inc., 1947. 748 pp., illus., diagrs. $7.50.

This excellent work is intended to serve as a general treatise and reference book on the design of radar systems. It is largely devoted to a discussion of microwave pulse radar, since by far the most work has been put into this type of equipment. The first eight chapters deal with the application, design, and development of radar systems; the radar equation; properties of radar targets; the limitations of pulse radar; c-w radar systems; the gathering and presentation of radar data; the employment of radar data; and radar beacons. Among the subjects discussed in other chapters are antennas, scanners, and stabilization; the magnetron and the pulser; radio-frequency components; the receiving system; prime power supplies; examples of radar system design; moving-target indication; radar relay; radio-frequency equipment; and radar relay systems. This book reveals many aspects of the extensive development work on radar carried out during World War II.

Dive Bombing. Erik A. Wilkenson. Stockholm, AB Seelig and Co., 1947. 195 pp., figs. (In English.)

In 1940 the author suggested a method of precision dive bombing which later was developed by the Saab Aircraft Company of Sweden and now has been adopted by the Royal Swedish Air Force. The Treatise represents an extension of the fundamental theoretical investigation of the special bombing method that was made during the development period. It is also a review of problems connected with dive bombing, especially those having to do with the release of the bomb in the pull-out from a dive and with the atmospheric and mechanical movements involved. In the last chapter

the special bombing method is described in detail and compared with other bombing methods.

It is explained that with the new method the pilot dives the airplane straight toward the target, aiming by means of a fixed sight approximately in alignment with the direction of flight. The pilot sets an automatic instrument in operation and then begins to pull out of the dive. The instrument measures the various factors influencing the proper release and gives the impulse that releases the bomb at just that moment in the pull-out when the aircraft attains the correct attitude for release. Alignment of the sight should not be too difficult, because the sight is approximately in the direction of flight toward the target. Ending the dive with a sufficiently correct pull-out should also be accomplished easily. The instruments can be designed to cope with wide variations of such factors as dive angle, height of release, and speed. The curvature of the bomb trajectory is compensated for by the change of direction of motion of the aircraft during the pull-out. In order to clarify the main theme the author has compared and combined several entirely different technical subjects. Ballistics has been treated from the aeronautical point of view, dive-bombing attack has been studied schematically, and the possible accuracy attainable by atmospheric measurements has been studied through the use of simplified meteorology. Following the introductory section, which gives a survey of the various methods of bombing and the problems to be solved, chapters are devoted to parabolic ballistics, bomb drag effects, dive mechanics, atmospheric measurements, and bombing in the pull-out. The appendix, entitled "Bomb Ballistics," by Claës Walén, is followed by a list of symbols and a list of 95 references.

Airline Piloting. Raymond Bullock. Denver, Colo., Jeppesen and Co., 1947. 163 pp., diagrs. $3.50.

This is not a textbook of the technique and procedures of flying but rather a book that counsels the flier on the rules of conduct essential to his exacting career. It has been prepared especially for air lines, for schools and universities with flying courses, and also for the personal use of those who wish to become good copilots and eventually captains. The book is based on the long experience of an air-line captain who is still flying for Western Airlines. While flying, the author took notes covering all phases of his individual trips in order to set forth to other pilots the knowledge he gained. The subject is presented in lively prose, which keeps the reader interested in his study. A few of the many phases of the subject discussed include maps and navigational equipment, calculators and flight plans, company manuals and bulletins, the airway manual, the Link trainer, airway traffic control, engine and airplane log books, engines, instruments, weather, air-line dispatchers, the Civil Aeronautics Administration, check flights and tests for ratings, and instrument flying.

Air Power and War Rights. J. M. Spaight. 3rd Ed. New York, Longmans, Green and Co., 1947. 533 pp. $10.

Since the second edition of this book was published in 1933, the author has found it necessary to make extensive alterations and additions in order to review war rights in the light of new conditions and the events of the second World War. In its revised form the book covers World War II, as well as the wars in China and Spain. The first chapter deals with air power in World War I and remains substantially as it was in the original edition, for, as the author points out, it was in that war that the international law of the air began to take shape and rules were established which largely set the standard for subsequent wars. How the conclusions then reached have been affected by later events is brought out in Chapters II and XI, which deal with the second World War. Chapters III to X discuss the laws of air warfare, the opening of hostilities of World War II, belligerent conduct, ruses, weapons and projectiles, bombing in the first World War, and the bombing problems from 1919 to 1939. Later chapters consider the bombing of privileged buildings, special missions of the air, distribution of propaganda by aircraft, enemy casualties, civil aircraft, the belligerent entry of neutral jurisdiction, neutral volunteers and supplies, and aircraft operation against merchant shipping. Topics under consideration are illustrated by many interesting specific examples. An appendix contains the draft rules proposed by a commission of jurists at The Hague in 1923.

Atlanterhavs-Flyvninger. I—Fra La Mountain til Lindbergh. II—Fra Lindbergh til Dan Viking. E. A. Tryde and Knud Clauson-Kaas. Copenhagen, Carit Andersen, 1946–1947. 2 Vols. 111, 219 pp. (In Danish.)

In this Danish work, all transatlantic flights including plans and attempts are recorded, both northern and southern, up to the regular operation of the Douglas Skymaster "Dan Viking" on the Copenhagen–New York route of Det Danske Luftfartselskab. Dr. Tryde is a private pilot who has drawn on his extensive collection of aeronautical newspaper clippings in the compilation of this work. His coauthor was a draftsman at Standard Aircraft Corporation in World War I and later was an army pilot in Denmark. As a civilian he planned an Atlantic flight from New York. The first volume begins with La Mountain's ascension in the balloon "Atlantic" from Watertown, N.Y., in 1858, and includes all airship activities, as well as airplane flights, to the end of 1926. The second volume begins with a correct appraisal of Lindbergh's work and thereafter brings developments up to date. What gives the book lasting value to American readers are the chronological listings with details of all transatlantic flights and attempts by airships and airplanes at the end of each volume.

ERIK HILDES-HEIM

Practical Aircraft Hydraulics. S. G. Bloxham. London, Sir Isaac Pitman and Sons, Ltd., 1947. 146 pp., diagrs. 18*s*.

A great deal of practical information about hydraulics as applied to aircraft is presented in this book. Although prepared primarily for those with some knowledge of hydraulics, the author touches on some elementary scientific points in the introductory pages. He then discusses the design principles of aircraft hydraulic systems in clear, easily understood language without recourse to involved scientific discussions or complex data. He selects examples that illustrate principles rather than exceptional ingenuity or efficiency. The book is intended primarily for the use of engineering students and those seeking aircraft engineers' licenses, and the author has succeeded in his aim to make it a thoroughly practical discussion. Phases of the subject dealt with include details of hydraulic equipment, jacks and other hydraulic units, hydraulic service, installation, operation, and manufacturing and other faults. There is a chapter on hydraulic shock-absorber struts and the oleo-pneumatic brake and another on the de Havilland hydromatic propeller.

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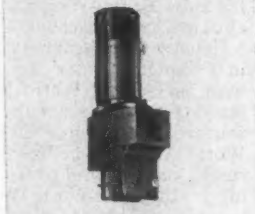

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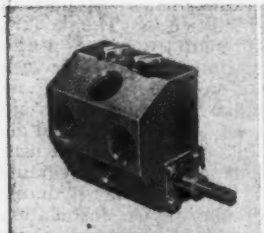

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Sections and Branches

(*Continued from page 9*)

ust (including an unofficial meeting August 12), members devoted the August 5 session entirely to business.

At the unofficial meeting on the 12th, T. M. Butler of National Advisory Committee for Aeronautics addressed the group on "Opportunities with the N.A.C.A."

A film, *PBM-3 Wing Destruction Test*, was shown at the final meeting on August 19. Tentative plans were made for interesting films, guest speakers, and social activities. Lionel L. Levy, Jr., Secretary, presided at the meetings.

University of Detroit

At the June 10 meeting, James Glander, Chairman, the following officers were elected for the year:

Russell J. Cornair, Chairman; Arthur W. Hindenlang, Vice-Chairman; Francis J. Janik, Secretary; and Robert E. Blatz, Treasurer.

Following the elections, new Chairman gave a short talk in which he outlined plans for increasing membership and for placing this Student Branch as one of the foremost engineering societies in the University.

The new Chairman, Russell Cornair, presided at the July 17 meeting, first part of which was taken up with a discussion of programs of future meetings.

Second part of the meeting featured the film, *Aerobatics of the P-47*. A short discussion of the film by the group followed.

Georgia School of Technology

Meeting in the Daniel Guggenheim School of Aeronautics July 16 and August 12 under chairmanship of Edmund E. Novotny, Branch members heard Joseph Hamrick, Graduate Student, and Prof. Alan Pope, Associate Professor of Aeronautics, Director of Wind Tunnel Testing, and Honorary Chairman.

Hamrick, speaking at the July 16 meeting on the subject "The Engineering Department of an Airplane Plant," outlined types of work done by the various groups composing the engineering department in the industry.

Speaking from experience gained with The Glenn L. Martin Company and the Douglas Aircraft Company, Inc., he gave members a brief picture of the type of work they may get into upon graduation.

Professor Pope, who gave a talk on "High-Speed Wind Tunnels," highlighted his subject with anecdotes on the practical problems of operating a research wind tunnel. Describing the design and operation of three small, high-speed tunnels, he pointed out their separate advantages, both from the point of view of economy and range of operation.

The information discussed was taken from a design study of a proposed wind-tunnel installation to be made at the Daniel Guggenheim School of Aeronautics at Georgia Tech.

Indiana Technical College

Meeting August 15, retiring officers turned over administrative equipment to new officers elected as follows: Jack L. Bickhard, Chairman; Manuel P. Costa, Vice-Chairman; Robert L. Hatch, Secretary; and Owen M. Gray, Treasurer.

The term banquet also was given August 15 at the Berghoff Gardens.

Mississippi State College

Second meeting of the summer session was held July 31, Harry Commodore Smith, Vice-Chairman, presiding. Two motion pictures, *Powerhouse* and *Cyclone Combustion*, by Wright Aeronautical Corporation, were shown.

In discussing plans for the fall semester, it was decided the first fall meeting would be held 2 weeks after registration. Officers for the coming year would then be elected.

News of Members

Franklin Chester Albright resigned as Project Engineer with Consolidated Vultee to join the engineering staff of Bendix Products Division, Bendix Aviation Corporation. He will handle special aircraft design problems.

Kenneth B. Amer, A.A.F. veteran, is Helicopter Flight Test Engineer, Langley Memorial Laboratory, N.A.C.A. He received his M.S. in A.E. from M.I.T. last June.

Charles T. Boehnlein, former Lt. Comdr., U.S. Naval Academy, is an Engineer with Douglas Aircraft Company, Inc.

Donald W. Bone is Stress Analyst, Grumman Aircraft Engineering Corporation.

Joel E. Brown is an Aerodynamicist with Douglas Aircraft Company, Inc.

Robert A. Davis is now Instructor in the School of Aeronautics, New York University.

Gilbert DeVore, formerly with Fairchild Engine & Airplane Corporation, now is Flight Analyst with C.A.A.

Constantine B. Dolkas is Research Assistant, Polytechnic Institute of Brooklyn.

Edward F. Dudek, Jr., resigned as Research Engineer, United Aircraft Corporation, to become Instructor, University of Nebraska.

R. Norman Evensen, Navy veteran, is Assistant Scientist, University of Minnesota.

Edwin R. Fay is Aerodynamicist "B," Consolidated Vultee Aircraft Corporation.

Henry Fiedler, formerly Senior Stress Analyst, Goodyear Aircraft Corporation, was named President, Fiedler & Schmidt, Inc.

George Fotieo, former Grumman Aircraft engineer and A.A.F. veteran, is Engineer, Division of Ind. Co-op, M.I.T.

Arthur P. Fraas, formerly with Case School of Applied Science, is Associate in Motors, Aeronautical Institute of Technology of Brazil.

J. C. Franklin resigned as T.W.A. Vice-President–Engineering to become Manager of U.S. Atomic Energy Commission's Oak Ridge, Tenn., Division.

Harry F. Frissel is Senior Engineer, Cornell Aeronautical Laboratory.

William G. Fuller was named Chief of Airports Management Division in Office of Airports, C.A.A., by Administrator T. P. Wright. Fuller formerly was Airport Manager at Ft. Worth and later helped to set up Globe Aircraft Company, serving as Factory Manager and as Vice-President.

Robert E. Gardner, resigned from Curtiss-Wright Corporation, is Research Engineer with Cornell Aeronautical Laboratory.

J. C. Franklin.

Jack Bruce Gearhart, former Navy Experimental Flight Test Analyst, now is Flight Analyst, Northrop Aircraft, Inc.

Frederick W. Geiger has been appointed Head, Aerodynamic Branch, Aerodynamics Department, Cornell Aeronautical Laboratory.

Thomas J. Gibbons, Jr., is Sales Engineer, Minnesota Mining & Manufacturing Company.

Robert R. Gilruth, formerly Assistant Aeronautical Engineer, is Chief, Pilotless Aircraft Research Division, N.A.C.A., Langley Field.

Lloyd T. Goodmanson is Chief of Wind Tunnel, Boeing Aircraft Company; was formerly Aerodynamicist.

Myron L. Gossard is Structural Engineer, Aeronautical Research, Langley Memorial Aeronautical Laboratory, N.A.C.A.

Dr. Leonard Greene is President, Safe Flight Instrument Corporation.

Col. H. Franklin Gregory, who headed A.A.F.'s helicopter, cargo, liaison, reconnaissance, and photographic aircraft development for many years, and a recent graduate of the Armed Forces Staff College, Norfolk, Va., after 2 years' overseas service, is now assigned to Headquarters, U.S.A.F., Office of Assistant Chief of Air Staff-3, Washington, D.C.

Joseph M. Gwinn, III, former Stress Analyst, Consolidated Vultee, now is Research Aerodynamicist, Cornell Aeronautical Laboratory.

George H. Hufferd resigned as Engineering Vice-President of the Weatherhead Company.

Walter C. Jamouneau, Chief Engineer, Piper Aircraft Corporation, was named Secretary and Assistant Treasurer to succeed W. T. Piper, Jr., it was announced by William T. Piper, Sr.

James Byron Jones is Chief Mechanical Engineer, Deering Milliken Research Trust. He formerly was with Goodyear Aircraft Corporation as Manager, Aerophysics Department.

Frank Kabase, former Power Plant Analyst, Curtiss-Wright Aircraft Division, is now at Air Proving Ground Command, Eglin Field, Fla., as Aircraft Performance Analyst with U.S.A.F.

William P. Kennedy is Aerodynamicist, Aircraft Research and Development Division, Willys-Overland Motors, Inc.

Paul Kleinman has returned to Edo Aircraft Corporation as Engineer.

Louis R. Koepnick has been named Chief Engineer of Trans World Airline; was Director of Base Engineering for past year. He is assuming duties formerly handled by J. C. Franklin, resigned.

Richard W. Lederer, Design Layout Engineer with Curtiss-Wright, resigned to become Designer "B," Consolidated Vultee Aircraft Corporation.

Milton Lief is Project Engineer with American Fixture & Manufacturing Company; was Flight Test Engineer with Curtiss-Wright.

Lloyd L. Long, Navy veteran, is Aerodynamicist, Beech Aircraft Corporation.

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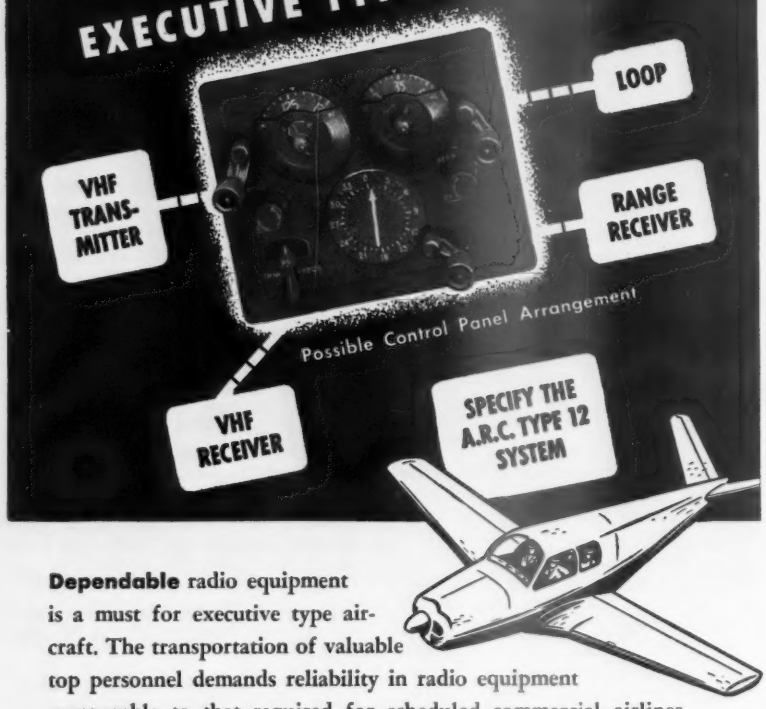

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Paul W. Lynahan, former Draftsman with Fleetwings Division, Kaiser Cargo, Inc., is with The Glenn L. Martin Company as Senior Layout Designer.

Charles A. MacGregor is Aerodynamicist, Northrop-Hendy Company.

Raphael A. Marcus temporarily is a Marine Engineer on a Canadian ship.

Robert A. Mendelsohn, former Junior Engineer with N.A.C.A., now is Head of Aerodynamics Dept., Continental Aviation & Engineering Corporation.

G. W. Newton, Power Plant Unit Chief, Boeing Aircraft Company, said present power plants were reliable for operations up to 30,000 ft. but that "prohibitive design changes" were necessary for flight above 40,000 ft. Until gas turbines are perfected, he added, speaking in Seattle at Boeing's 3-day symposium on high-altitude flight, turbosupercharged piston engines are superior to other presently available equipment.

Rodney Noble, formerly with Trans Australia Airlines, is Flight Lieutenant, R.A.A.F., Directorate of Technical Services.

Bruce H. Packard is Engineer, Ames Aeronautical Laboratory, N.A.C.A.

Emil A. Polowniak is Hydraulic Design Engineer, McDonnell Aircraft Corporation. He has been elected to supervise the Service School dealing with line maintenance and erection of the McDonnel jet plane, Phantom.

Dr. Walter Ramberg was appointed Chief of the Mechanics Division, National Bureau of Standards, succeeding Dr. Hugh L. Dryden. Dr. Ramberg has been Chief of a section in the Mechanics Division since 1946; has international reputation for his work in aeronautics, particularly in the field of strength and stability of structural elements in aircraft.

Orville L. Richardson, former Senior Aerodynamicist with The Glenn L. Martin Company, is Aeronautical Engineer, Bureau of Aeronautics, Navy Department.

Cyril Bruce Rogers is Engineer Designer, Consolidated Vultee Aircraft Corporation, Ft. Worth Division.

Inz Rylski, former R.A.F. Flight Lieutenant, has joined the staff of Non Ferrous Laboratory, Department of Mines & Resources, as Engineer 3rd Grade.

Edward J. Sadowsky is Engineer, Wright Aeronautical Corporation.

John L. Sanders, Jr., is Aeronautical Engineer, Langley Memorial Aeronautical Laboratory, N.A.C.A.

Herbert T. Schramm, formerly Engineer with Curtiss-Wright Corporation, now is owner, H. T. Schramm Die Casting Products.

Dr. Hyman Serbin is now Professor of Aeronautical Engineering, Purdue University.

Joseph H. Sirc is an Instructor at University of Pittsburgh.

George Sonnemann is Assistant Instructor, Newark College of Engineering.

Herman B. Spiegel, formerly with Philco Products, Inc., now is Senior Machine Designer, Philco Radio & Television Corporation.

William R. Steinberg is Layout Draftsman, Chance Vought Aircraft Division, United Aircraft Corporation.

Ray Stearns, Engineer in Charge of General Electric Company's Marine & Aeronautics Engineering Division, retired September 1 after 45 years of service.

Edward L. Stickel is now an Associate Engineer in the Operational Group of Trans World Airline's International Division, Engineering Department, New Castle, Del. He is doing weight, balance, and performance work.

Joseph W. Stout, Jr., is Operations Agent, Delta Air Lines, Inc.

Dr. Robert E. Street, former Engineer with General Electric Company, is Associate Professor of Physics, University of New Mexico.

Harold R. Sweet, Marine Corps veteran, is Instructor, Department of Rational & Technical Mechanics, Rensselaer Polytechnic Institute.

Milton F. Veck is Project Engineer, Development Division, Cornell Aeronautical Laboratory; formerly was with Curtiss-Wright Airplane Division.

Harry H. Wallace is Senior Liaison Engineer, N.E.P.A. Division, Fairchild Engine & Airplane Corporation.

Maynard I. Weinstein is with N.A.C.A. as Aeronautical Engineer, Aircraft Engine Research Laboratory.

Robert A. Wells is Sales Engineer, Aviation Department, Gulf Oil Corporation.

George White, former Structures Engineer with Curtiss-Wright Corporation, is President and General Manager of Dansaire Corporation.

Horace H. Willis is Director, Research and Development, The Kellex Corporation.

Murray Winkelman resigned from Fairchild Aircraft to become Structural Engineer, Chance Vought Aircraft Division, United Aircraft Corporation.

Edward C. Woodruff, Jr., is Detail Draftsman, Hamilton Standard Propellers Division, United Aircraft Corporation.

Yih Chang Yang, former Teacher, Virginia Polytechnic Institute, is Aeronautical Engineer, Universal Trading Corporation.

Roy Edward Yorke is Engineer, American Car & Foundry Company.

David L. Zacharias is Assistant Treasurer and Controller, Michael Baker, Jr. (Consulting Engineers).

John Thomas Zachary is Aerodynamicist "B," North American Aviation, Inc.

Members Elected

The following applicants for membership or applicants for change of previous grades have been admitted since the publication of the list in the last issue of the REVIEW.

Transferred to Associate Fellow Grade

Dexter, Robert Reginald, Ae.E., Secretary, Institute of the Aeronautical Sciences, Inc.

Fabierkiewicz, Z., M. of M.E., Stress Analyst, Canadair, Ltd. (Canada).

Jones, Charles Sherman, Dr.Sc., President, Casey Jones School of Aeronautics, Inc.

Kelly, Thomas Nelson, B.S. in Ae.E., Asst. Head of Jet Expr. Dept., Continental Aviation & Engineering Corp.

Kirkbride, Charles Elwell, Executive Asst. to Manager of the Naval Aircraft Factory, Naval Base, Philadelphia; Capt., U.S.N.R.

Libby, Charles Jackson, B.S. in E.E., Designer in P/A Sect., The Glenn L. Martin Co.

Murray, James Lore, B.S. in Ae.E., Major, U.S. Army Air Forces, In Charge of Icing Research Project, Ames Aero. Lab., N.A.C.A.

Elected to MEMBER Grade

Austin, Frederick, Chief Surveyor (Canada and U.S.), Air Registration Board.

Bott, Alan Richard, B.S.E. (Aero Option), Lt. (j.g.), Naval Aviator and Project Officer, N.A.T.C., U.S. Navy.

Dunham, Seymour W., Civilian Chief, Design Branch, Aircraft Lab., Engineering Div., War Dept., A.M.C., U.S. Army Air Forces.

Evans, Guy H., B.S. in Ae.E., President, Sole-Owner, Technical Airline Representation, Guy H. Evans, Inc.

Floyd, James Charles, Asst. Designer, A. V. Roe Canada Limited (Canada).

Harman, Leonard F., B.S. in M.E., Dayton Representative Engineering Coordination, Northrop Aircraft, Inc.

Harvey, Hugh, B.A., Technical Representative (Aviation), Shell Oil Co., Inc.

Hausmann, George Finley, B.S. in Ae.E., Supervisor—in Charge of Gas Dynamics Lab., United Aircraft Corp.

Linehan, Frank O., B.C.E., Consulting Engineer.

Loedding, Alfred C., B.S. in M.E. (Aero Option), Technical Asst. to Chief, Analysis Div., Air Matériel Command, Intelligence T-2, (Wright Field).

McLaughlin, Edward J., B.S., Lab. Supervisor, Engine Fuel Lab., California Research Corp.

Michaels, Walter C., B.S. in M.E. (Aero Option).

Miles, Edward R. C., Ph.D., Research Engineer, Supersonic Aerodynamic Project, The Glenn L. Martin Co.

Potter, Ray Maxwell, Director of Engineering Research, Smith, Hinchman & Grylls, Inc.

Priebe, Paul D., A.B. (Ae.E. and Physics), Sr. Engineer, Flight Analysis Section, American Overseas Airlines.

Robinson, Richard Gabriel, Inspector. Aer Lingus (Ireland).

Rough, Howard F., Asst. Administrator—Field Operations, C.A.A.

Spencer, Hugh Harding, MS-EE., Sales Engineer, R.C.A. Victor Div., Radio Corp. of America.

Slattery, John J., B.S. in E.E., Asst. Director of Engineering, Signal Corps Engineering Laboratories.

Thompson, Edward Stoops, M.Sc. in M.E., Manager, Aircraft Gas Turbine Div., General Electric Co.

Tucker, Maurice, B.S. in E.E., Aeronautical Engineer, Aircraft Engine Research Lab., N.A.C.A.

Worraker, Sydney Bernard, Chief Engineer, Aero Trades, Inc.

Transferred to MEMBER Grade

Crichlow, Walter Jack, B.A., Project Structures Engineer, Lockheed Aircraft Corp.

Crowell, William Eleazor, B.S. in M.E., Section Head, Aircraft Equipment Research Section, Cornell Aero. Lab.

Davies, Walter Moore, B.S. in E.E., Secretary and Treasurer, Allied Aircraft Co. Inc.

Ellis, Frampton Erroll, Jr., B.S. in Ae.E., Head, Pilotless Aircraft Design Research Section, Bureau of Aeronautics, Navy Dept.

Huntsberger, Ralph Francis, Jr., Ae, in charge of constructing new 6 ft. by 6 ft. Supersonic Wind Tunnel, Ames Aero. Lab., N.A.C.A.

Hwang, Chen Ya, B.S., Capt.—Engineer, Chinese Air Force; also Liaison Engineer, Boeing Airplane Co. (Wichita Div.)

Lindstrom, Frederick Aasgaard, B.C.E., Stress Analyst, Consolidated Vultee Aircraft Corp.

Pollock, Robert Thomas, B.S. in Ae.E., Mathematician "A," Consolidated Vultee Aircraft Corp.

Wendt, Ralph Edson, B.M.E. (Aero Option), Aerodynamicist, North American Aviation, Inc.

Wessale, John, B.S. in Ae.E., Operating Partner, Waconia Sorghum Co. (Cedar Rapids, Iowa).

Elected to Associate Member Grade

Brearley, William Henry, Jr., B.S., Aircraft Test Engineer, Operations and Test Branch, Engineering Dept., Naval Air Matérial Center, Naval Aircraft Factory (Philadelphia).

Dickman, Walter H., Technical Advisor and Purchasing Agent, Aviquipo, Inc.

Dillenbeck, Juney, M.S., Research Asst. to Vice-President of Economics, Scandinavian Airlines System (Sweden).

Gimbel, Richard, A.B., Col., Chief, Civilian Personnel Div., U.S. Army Air Forces (Wright Field).

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McIntyre, Henry L., A.B., Asst. to the President, United Helicopters, Inc.

O'Farrill, Romulo, Jr., Vice-President, Automotriz O'Farrill, S.A., (Mexico).

Whipple, Allen Oldfather, Jr., AB., Sales Asst., Chance Vought Aircraft Div., United Aircraft Corp.

Transferred to Associate Member Grade

Graham, Glenn Erwin, B.Sc., Executive Engineer, Jeppesen and Co.

Westfall, Vernon Dale, Engineering Test Pilot, Hartzell Propeller Co.

Elected to Technical Member Grade

Bitondo, Domenic, B.S.

Durham, J. Delmont, B.S. in M.E., Aero. Research Scientist, Altitude Wind Tunnel, Aircraft Engine Research Lab., N.A.C.A.

Miller, Yeakle Wayne, Draftsman, Firestone Aircraft Co.

Purdon, David, Ae., Lt. Comdr., Naval Aviator, U.S. Navy.

Seide, Paul, B. of C.E., Civil Engineer (P-2), Structures Research Div., Langley Mem. Aero. Lab., N.A.C.A.

Shuff, John Winfred, B.S., Lt., Naval Aviator, U.S. Navy.

Trautman, William Robert, Administrative Asst., Cornell Aero. Lab.

Transferred from Student to Technical Member

Beatty, Hall Eugene, B.Ae.E.

Berger, Russell Emerson, B.S. in Ae.E., Aeronautical Engineer, Chance Vought Aircraft Div., United Aircraft Corp.

Broker, Robert Harvey, B.Ae.E., Engineering Trainee, Chance Vought Aircraft Div., United Aircraft Corp.

Byrd, Clinton Lincoln, B.S.

Cohen, Harold Isadore, B.S.

Corbell, Louis Manen, B.S., Graduate Student and Research Asst. at Purdue University, U.S. Navy Program.

Daggy, Earl N., Jr.

Dehn, Donald Harvey, B.S. in Ae.E.

Dekker, Raymond Simon, B.S., Student, Aeronautical University.

Demetropoulos, James, B.Ae.E.

Eckert, Francis Mills, B.Sc., Jr. Flight Test Instrument Engineer, The Glenn L. Martin Co.

Ellis, Charles William, Ae.E., Aero. Engineer, Aircraft Engine Research Lab., N.A.C.A.

Gail, George William, Jr., Associate in Arts, Engineer, Chance Vought Aircraft Div., United Aircraft Corp.

Gardenier, Hugh Emory, B.S. in Ae.E., Research Analyst, Consolidated Vultee Aircraft Corp.

Haddock, William Samuel, Jr., B.S. in M.E., Jr. Layout Designer, Chance Vought Aircraft Div., United Aircraft Corp.

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Judd, Joseph Hugh, B.Ae.E., Aeronautical Engineer, Langley Mem. Aero. Lab., N.A.C.A.

Keith, Reuben Stanley, B.S., Student.

Krokus, Donald Jerome, B.Ae.E., Mathematician "A," Douglas Aircraft Co., Inc.

Kusnerek, Jean Marie, Miss, B.Ae.E., Jr. Scientist, University of Minnesota, Aeronautical Lab.

Leadon, Roland Eugene, M.S. in Ae.E., Aerodynamicist, Consolidated Vultee Aircraft Corp.

Levine, Sylvan Eugene, B.S. in Ae.E., Engineer, American Car & Foundry Co.

Lopez, Joaquin, B.Sc. in Ae.E., Engineer, Ministerio de Obras Publicas (Cuba).

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Mazzitelli, Frederick Rocco, B.Sc., Aero. Engineer, Piasecki Helicopter Corp.

Melby, George Martin, B.S., Instructor, Aeronautical Engineering, Wayne University.

Mitchell, Thaddeus Richard, B.S. in Ae.E., Graduate Student, Tri-State College.

Musil, Jay Louis, B.S. in Ae.E.

Morris, Ralph Norman, B.S. in Ae.E., Teacher, Rainier High School (Wash.)

O'Brien, Timothy Frederick, S.B., in Ae.E., Staff Member, Div. of Industrial Cooperation, M.I.T.

Paris, Carl James, B.S. in Ae.E., Designer, Chance Vought Aircraft Div., United Aircraft Corp.

Priest, Roy R., Jr., B.S. in Ae.E., Layout Designer, Class B, McDonnell Aircraft Corp.

Reddinger, Koe, Miss, B.S.

Reyes, Jaime Ortiz, Assoc. in Arts in Ae.E., Student, Spartan College.

Roberts, Frank, Jr., B.S. in Ae.E., Analytical Engineer, Pratt & Whitney Aircraft Div., United Aircraft Corp.

Robinson, William Robert, B.Ae., Designer, Surface Controls Group, McDonnell Aircraft Corp.

Scroggs, Arden M., B.S. in Ae.E., Aerodynamicist, Boeing Aircraft Co.

Segel, Leonard, B.S. in Ae.E., Jr. Engineer, Cornell Aero. Lab.

Solomon, Phillip, B.S., Instructor, New England Aircraft School.

Strasser, Betty Mae, Miss, B.Sc. in Ae.E.

Vogel, Theodore Alvin, B.Ae.E., Flight Test Analyst B, Consolidated Vultee Aircraft Corp.

Westkaemper, John Conrad, B.S. in Ae.E., Lab. Research Analyst, Consolidated Vultee Aircraft Corp.

White, John Henry, B.S. in Ae.E.

Willer, Jack Edward, B.S. in Ae.E., B.S. in Naval Science, Asst. Aerodynamicist, McDonnell Aircraft Corp.

Young, James Roland, Student Engineer, University of Colorado.

Necrology

Edgar Nathaniel Gott

Edgar Nathaniel Gott, one of aviation's pioneers in this country, died July 18, 1947, at the age of 60, following an illness. At the time of his death he was Assistant to the President, Consolidated Vultee Aircraft Corporation. He had been with the company since 1936 (then Consolidated Aircraft Corporation).

Born in Detroit on May 2, 1887, he was educated at Detroit University School and the University of Michigan, graduating in 1909. He became associated with the Griffin Wheel Company until 1915, when he resigned to become Vice-President and General Manager of Boeing Airplane Company. He was President of that company from 1922 to 1925. Upon leaving the Boeing company, Ed Gott joined Fokker Aircraft Corporation as Vice-President, where he remained a year and then was elected President of the Huff Daland Airplanes, Inc., which then was one of the largest airplane plants in the country. The company later was renamed Keystone Aircraft Corporation.

In 1932, Gott retired for several years, returning to the industry in 1936 as Assistant to the President of Consolidated Aircraft Corporation. He was named Vice-President in 1938. Since 1928 he had held a commission as Major in the Specialists Reserve Corps, Air Corps Reserve.

Throughout his career Edgar Gott's activities embraced the field of management, sales organization, and contacts of public relations of a diversified nature. He was elected an Industrial Member of the Institute in 1940.

I.A.S. National Meeting Schedule

Wright Brothers Lecture—U. S. Chamber of Commerce Auditorium, Washington, D.C.—December 17, 1947

Sixteenth Annual Meeting—Hotel Astor, New York—January 26–29, 1948

Members or organizations wishing to submit papers for presentation at National Meetings should send outlines or summaries to the Committee at least 3 months prior to the meeting.

All papers submitted will be considered for publication in the *Journal of the Aeronautical Sciences* or the *Aeronautical Engineering Review.*

All correspondence should be addressed to The Meetings Committee, Institute of the Aeronautical Sciences, 2 East 64th Street, New York 21, N.Y.

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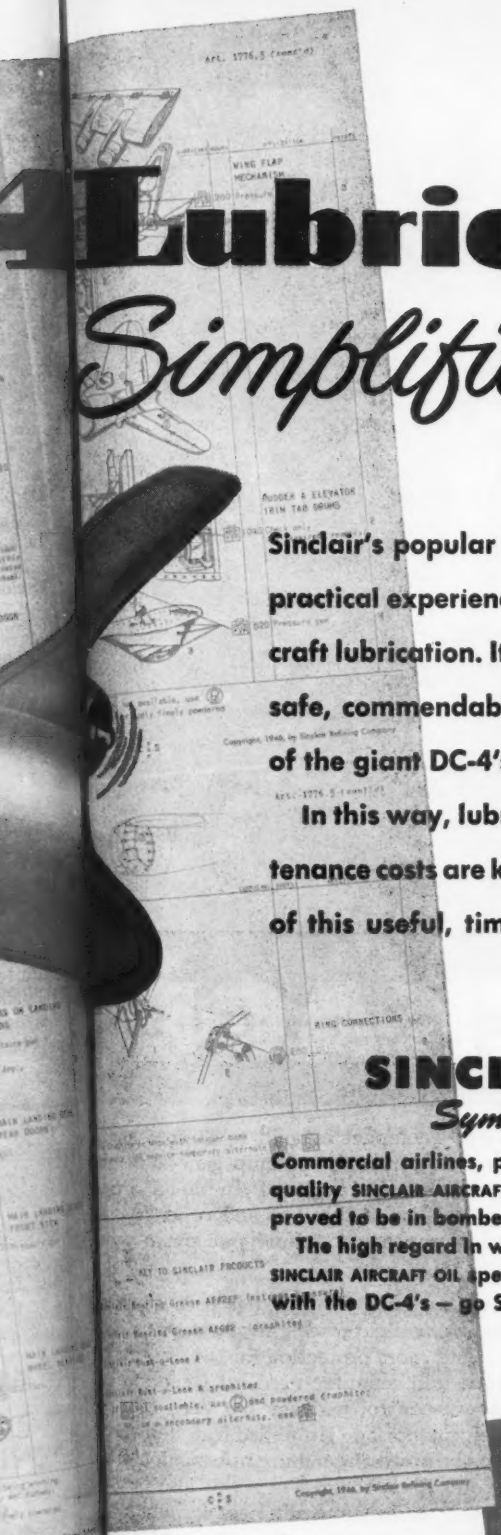

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Engineers—Long-term helicopter development program for Army Air Forces requires additional engineering personnel: (1) stress engineers with 4 or more years' experience, (2) senior layout men, and (3) mechanical draftsmen. Apply in writing to Manager, Helicopter Division, Kellett Aircraft Corporation, North Wales, Pa.

The U.S. Naval Air Station, Pensacola, Fla., is accepting applications of highly qualified and experienced personnel for various positions as follows: **Industrial Engineer,** P-6 at $7,102.20 per annum, P-3 at $4,149.60 per annum; **Organization and Methods Examiner,** CAF-9 at $4,149.60; **Methods Examiner—Forms,** CAF-7 at $3,397.20 per annum; **Engineer Draftsman—General,** SP-6 at $2,644.80 per annum; **Statistical Draftsman,** CAF-5 at $2,644.80 per annum. Applicants may obtain Civil Service Application Form 57 from their local post office. Forward applications, completely filled out, to the Recorder, Board of U.S. Civil Service Examiners, U.S. Naval Air Station, Pensacola, Fla.

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Assistant Professor—To teach courses in aircraft structures. The primary duties of the position will be concerned with aircraft structures, but the applicant should possess enough knowledge of aerodynamics to permit him to assist occasionally in elementary aerodynamic courses. Prefer a man with teaching and practical experience. In applying, please give brief sketch of personal qualifications, education, and experience. Address: Acting Dean R. P. Davis, College of Engineering, West Virginia University, Morgantown, W.Va.

Aircraft Dynamics Engineers—For research work on subsonic and supersonic flutter, vibration, dynamic loads, stability and control of supersonic missiles, and helicopter dynamic problems. Applicants must have good background in fundamentals of applied mechanics and mathematics. Advanced degree or previous experience in field is essential. Salaries commensurate with training and experience. Cornell Aeronautical Laboratory, Employment Office, 4455 Genesee St., Buffalo 21, N.Y.

Servomechanism Engineers—Experienced in analysis, design, or testing of electrical or hydraulic servomechanisms or powered flight controls. Strong knowledge of stability analysis and test methods desired. Salary commensurate with training and experience. Inquire Personnel Manager, Boeing Aircraft Company, Seattle 14, Wash.

Structures Engineers and Stress Analysts—Experienced in aircraft structures and stress analysis. Three to 10 years or more experience desired. Salary commensurate with training and experience. Inquire Personnel Manager, Boeing Aircraft Company, Seattle 14, Wash.

Hydraulic Engineers—Experienced in design and analysis of aircraft hydraulic mechanisms and components. Salary commensurate with training and experience. Inquire Personnel Manager, Boeing Aircraft Company, Seattle 14, Wash.

Mechanical Design Engineers—Experienced in design of light high-speed rotating machines. Also experienced in light and medium aircraft-engine and engine accessory design. Salary commensurate with training and experience. Inquire Personnel Manager, Boeing Aircraft Company, Seattle 14, Wash.

Structural Designers—Engineers experienced in design of sheet-metal structures desired for large cargo aircraft project. Graduate engineers preferred. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Layout Draftsmen—Six or more years' experience in aircraft layout and design. Cargo aircraft experience desired. Graduate engineers preferred. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Stress Analysts—Personnel with experience on sheet metal, monocoque, cargo-type aircraft desired. Graduate engineers with 5 or more years' experience preferred. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Chief Aerodynamicist—Services of highly qualified person to act as chief aerodynamicist. All applicants must be graduate engineers of recognized universities. Experience on cargo or large type of aircraft desirable. Applicants should write, giving complete details of education and experience, list references and salary expected, as well as availability. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Aerodynamicists—Several positions open to qualified personnel for performance and load calculations on cargo-type aircraft. Graduate engineers preferred with at least 5 years' experience. All replies held confidential. Write, Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Engineers—Attention newly graduated engineers: Opportunities for wide-awake hustlers who want to learn. Write, giving full particulars of scholastic record and any experience, to Project Engineer, Chase Aircraft Company, Inc., West Trenton, N.J.

Assistant Professor—Assistant Professor of Aeronautical Engineering wanted to teach junior and senior courses at Oregon State College. A man with graduate degree, teaching and industrial experience preferred. Address replies to B. F. Ruffner, Oregon State College, Corvallis, Ore.

785. Designers, Layout Draftsmen, Detail Draftsmen—Needed by New Jersey manufacturer for aircraft gas-turbine project.

762. Engineer—Graduate engineer, mechanical, experienced in precision transmission systems. Aggressive expanding company. Suburb of Philadelphia. Replies will be kept confidential. Send complete résumé.

761. Junior Electrical Engineers—Graduate engineers from recognized universities preferred. To work on aircraft electronic systems. Plant located in suburb of West Philadelphia. All replies will be held confidential.

760. Aircraft Electronic Engineer—Experienced in flight-test instrumentation. Plant located in suburb of West Philadelphia. All replies will be held confidential.

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783. Engineer—Age 32, B.M.E., M. Aero. E., with 7 years' varied experience in analysis and research on commercial and military aircraft structures, guided missiles and power plants, including gas turbines; emphasis on stress analysis, thermodynamics, and fluid flow.

782. Power-Plant Engineer—Eight years' experience in gas-turbine power plants for aircraft and industrial applications. In charge of installation, service, and sales departments. Well versed in the organization and administration of sales and service sections. Has overseas experience in the service and sales field, plus technical advisory experience to foreign manufacturers. Desires administrative position with progressive aircraft firm, air line, or cargo company or in an engine manufacturer's sales organization.

781. Power-Plant Development Engineer—Age 31; married; B.S. in Aeronautical Engineering, University of Michigan. Three years as test engineer on research and development of large aircraft-engine superchargers. Three years' experience on development of aircraft gas turbine. In direct charge of development of automatic high-speed air valves. One year as supervisor on large altitude chamber with adequate facilities for testing power plants at 100 per cent altitude conditions. Thorough training in fluid mechanics, thermodynamics, and airflow instrumentation. State registered.

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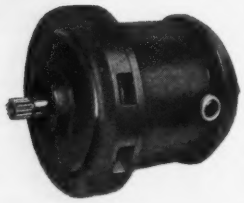

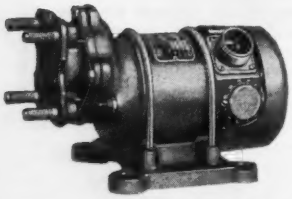

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779. Aeronautical Engineer—B.Ae.S. degree, University of Minnesota, 1940. Age 31, married. Six years' experience with prominent aircraft propeller manufacturer involving drafting, weight control, aerodynamics, plus extensive experience in installation engineering pertaining to aircraft propellers. Held supervisory position in Installations Department at time of resignation to form own airport operations organization. Location open.

777. High School Aeronautics Teacher—Age 29, married. Author of three technical books on aviation education, aircraft operations, aviation course of instruction for high schools and colleges. Twelve years' practical experience in operational aviation, all phases. Seven years' aviation teaching experience. Teaching aeronautics in a Southern high school at present. Would like better position teaching basic or primary aerodynamics and/or structures in a college offering aeronautical engineering or aeronautical courses.

776. Sales Engineer—B. in A.E., Rensselaer Polytechnic Institute; age 26, married. Four and one-half years' research experience plus 20 months spare-time study (International Correspondence Schools) of corporate organization and finance, business law, accounting, and marketing. Private pilot. Desires sales engineering connection in industry where the combination of sales ability with a sound engineering background will be valuable. Location open. Salary incidental to advancement opportunities.

775. Aeronautical Engineer—B.S. in Aeronautical Engineering. Age 28, single. Thirty-two months' experience, 17 months in design layout, 15 months in flight testing. Desires position in Eastern United States in flight testing or research. Will consider design layout.

774. Engineer—Age 26, married. B.Ae.E., N.Y.U., 1944. One year of graduate work at N.Y.U. including courses in compressible flow, gas turbines, structural analysis, and advanced mathematics. Expects M.Ae.E. in October upon completion of thesis. Two years' experience in maintenance and inspection of A.A.F. transport aircraft as engineering officer both in U.S. and Pacific Theater. Location open.

773. Pilot—Engineer—B.S.Ae.E. from Purdue University. Age 25, single. Presently holds valid commercial pilot's license with single- and multi-engined, instrument, and instructor ratings. Acquired extensive experience as B-29 flight engineer during war. Leaving present position as flight supervisor at large Midwestern university airport. Interested in sales engineering, pilot for private concern, or flight-test work. Will locate anywhere but prefers East Coast.

772. Aeronautical Engineer—Aerodynamicist; B. Aero. E., N.Y.U., 1943. Age 24, married. Four and one-half years' experience in all phases of aerodynamics (propeller and jet aircraft), with emphasis on flight test and performance analysis; experience in supersonic aerodynamics pertaining to guided missile development. Will consider college teaching. Metropolitan New York, Northern New Jersey, and Long Island areas preferred. Details and references upon request.

771. Mathematician — Engineer — Age 33; B.S., M.A., 60 graduate credits in mathematics;

4 years' evening mechanical engineering course. Six years' experience teaching mathematics; 2 years' experience in aerodynamics, including transonic and supersonic aircraft and missiles; 1 year as research engineer on auto pilot and hydraulic shock absorbers; 2 years' administrative experience as manager of service department with manufacturer of aircraft hydraulic pumps and landing gears. New York, New Jersey, or Long Island area preferred.

770. **Aeronautical Engineer**—B.Ae.E., 1942. Age 25, married. Two years' experience in design evaluation of regular and experimental aircraft. Two years' experience in aircraft flight testing and aircraft maintenance. One year's experience in supersonic research leading to the design of guided missiles. At present engaged as a research technician in supersonics. Desires position as an administrative or project engineer. Familiar with Government contracts and procedures.

769. **Aeronautical Engineer**—B.S. in M.E. (Aero.), 1942. Age 27, married. Five years' experience in layout and design on military and commercial aircraft. Some experience in wind-tunnel testing and aeronautical research. Desires permanent position with leading aircraft concern. Will locate anywhere in United States.

768. **Production-Management Engineer**—B.Ae.E., Rensselaer Polytechnic Institute, 1942. Five years' experience in engineering and management, including duties in liaison, salvage, design, and stress analysis. Three years' aircraft engineering officer in U.S. Marine Corps in complete charge of third echelon maintenance, repair, and overhaul, as well as command responsibilities. Desires responsible position requiring managerial capabilities in addition to engineering knowledge, such as production planning and control.

767. **Aeronautical Engineer**—Age 23, married. Four years' experience in air-transport field. Thoroughly familiar with aircraft structures and systems, weight and balance procedures, structural repairs, and servicing. Two years' experience in detail design and interior furnishing of large commercial aircraft including DC-3, DC-4, and L-49 aircraft. Desires position of responsibility in which engineering background will be of value. Available immediately.

766. **Aeronautical and Mechanical Engineer**—Age 25. B.S. in G.E. with A.E. Option from Georgia School of Technology. Considerable work toward M.S. completed. Three years' experience in the development of aircraft engines (conventional and jet) and propellers in the Engineering Division, Air Matériel Command, Wright Field, as an officer. One year's experience in theoretical analysis of power plants, rocket research and development, and aerodynamics for guided missiles. Considerable experience as a pilot. Interested in sales engineering. Will locate anywhere. No objection to traveling. Good references.

764. **Engineer**—Ph.D., Master's, and Bachelor's degrees; age 30. At present, Director of Aeromechanics Department for large corporation engaged in research, design, and development in supersonic and subsonic guided missile programs. Formerly, Associate Professor of Aeronautical Engineering at midwestern university, teaching theoretical aerodynamics, supersonic and compressible subsonic flow, dynamic stability, and wind-tunnel courses. Desires professorship or associate professorship at recognized university with the possibility of some research or consulting or a responsible position in industry with good future prospects.

763. **Teacher**—Desires position teaching aeronautical engineering at recognized college or university. B.A.E. degree, magna cum laude. Graduate work in engineering partially completed. Three years of progressively responsible industrial experience, including analysis and design of tubular and stressed-skin structures and of the mechanical elements of civilian and military aircraft, with emphasis in rotary wing field. One and one-half years' experience as instructor of mechanical engineering at accredited college. Qualified to teach courses in aerodynamics, fluid mechanics, advanced strength of materials, airplane design, structures and stress analysis, and rotary wing aircraft.

759. **Powerplant and Engine Accessory Designer**—Graduate M.E., German university. Extensive design and testing experience. Fully conversant with engine layout and all phases of development. Considerable design and research background on fuel injection systems.

757. **Flight Test or Research Engineer**—Aeronautical Engineering graduate with 5 years' experience in flight testing, flight research, and wind-tunnel testing. Has done military and C.A.A. acceptance flight tests. Special experience with large aircraft test organization. Intends to leave West Coast. Desires equivalent position in the East; New York or New England Coast preferred.

755. **Mechanical Engineer**—B.S. in Mechanical Engineering, age 28. Three years of performance estimation of gas turbines and thermodynamic analysis and design of gas turbine components. Three years of mechanical design of aircraft elements. Desires a responsible position with an active organization with plenty of work and an opportunity for advancement. Location unimportant.

754. **Aeronautical Engineer**—B.S. in Aeronautical Engineering, age 26. Forty months' experience in the Army Air Corps as an engineering officer in charge of maintenance and equipment development. Desires position in aerodynamic research but will also consider other positions. Sound theoretical background in stress analysis and aerodynamics as well as practical experience in heavy aircraft maintenance. Details and references upon request.

753. **Engineer**—B.M.E., 1943. Nine months' as assistant project engineer on automatic aircraft control. Two years as aerodynamics engineer on piloted and pilotless aircraft. For past 6 months in charge of projects to simulate in laboratory the behavior of guided missiles and their control equipment while in flight. Desires improved opportunities.

752. **Engineer**—Age 36, 3 years' college engineering; 2½ years as an engineer in the aircraft industry; specialist in weights and balance; holds valid A. & E. license; approximately 10 years all-round technician on all types of aircraft. Would like to represent aircraft manufacturer in the field.

751. **Aeronautical Engineer**—Seven years' air-line and manufacturing experience, mostly on heavy multiengined aircraft covering tool design, group leader equipment installation design, service and liaison engineering, flight testing, direction of preparation of flight and maintenance handbooks, and progressive maintenance systems for U.S. Navy and a major air line. Desires responsible position with air line or manufacturer, domestic or foreign. Excellent references furnished.

750. **Aeronautical Engineer**—B.Ae.E., age 24, single. Two years' experience in flight testing, primarily jet-propelled aircraft. Three and one-half years with A.A.F. as navigator, experimental engineering officer, and administrative officer. Seeks position in aeronautics, preferably development and/or liaison.

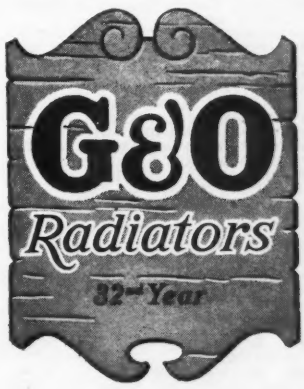
748. **Aeronautical Engineer**—Bachelor's and Master's degrees in Aeronautical Engineering. Presently holding responsible executive position with well-known helicopter manufacturer. Desires new connection either in industry or at recognized university. Broad general aircraft experience; author of several published papers on rotating wing aircraft and general design; well-known in industry and C.A.A. circles; teaching experience in field of structural design.

747. **Helicopter Flight Test Engineer**—Age 27, married. B.S.E. (Aero.), 1943. Familiar with C.A.A. flight test procedures and data reduction necessary for helicopter certifications. Four years' aviation experience includes flight-test instrumentation, conventional aircraft flight scheduling. Desires position in Midwest in related or nonrelated field where background would be of some benefit.

746. **Aerodynamicist**—Age 28; B.S. and M.S. degrees in Ae.E. Five years' experience in aerodynamic design of commercial and military aircraft. Considerable experience with static and dynamic stability analyses of aircraft. Desires responsible position either with aeronautical college or with aircraft industry.

745. **Aeronautical Engineer-Teacher**—Presently employed design engineer would prefer a change to teaching position. Work in aircraft industry or in aero-insurance field also desirable. Scholastic record includes B.S. degree in Mechanical Engineering and graduate study in applied mechanics, plus M.S. degree from Harvard Graduate School of Engineering. Over 6 years' industrial experience on gliders, large (four-engined), and small aircraft, amphibians and jets. Has been chief of structures and aerodynamics on light aircraft; handled approval of important aircraft designs while working for C.A.A.; has also handled safety and accident analysis, and C.A.A. design and liaison work for large aircraft manufacturer. Teaching experience includes graduate assistantship at leading university and appointment as Instructor in Aeronautical Engineering on part-time basis.

744. **Project Engineer**—Age 29; M.Ae.E. Nine years' experience in design and development of aeronautical and mechanical components. Recent experience in guided missiles and in direction of groups engaged in aeronautical development work. Especially interested in coordination of new development work.



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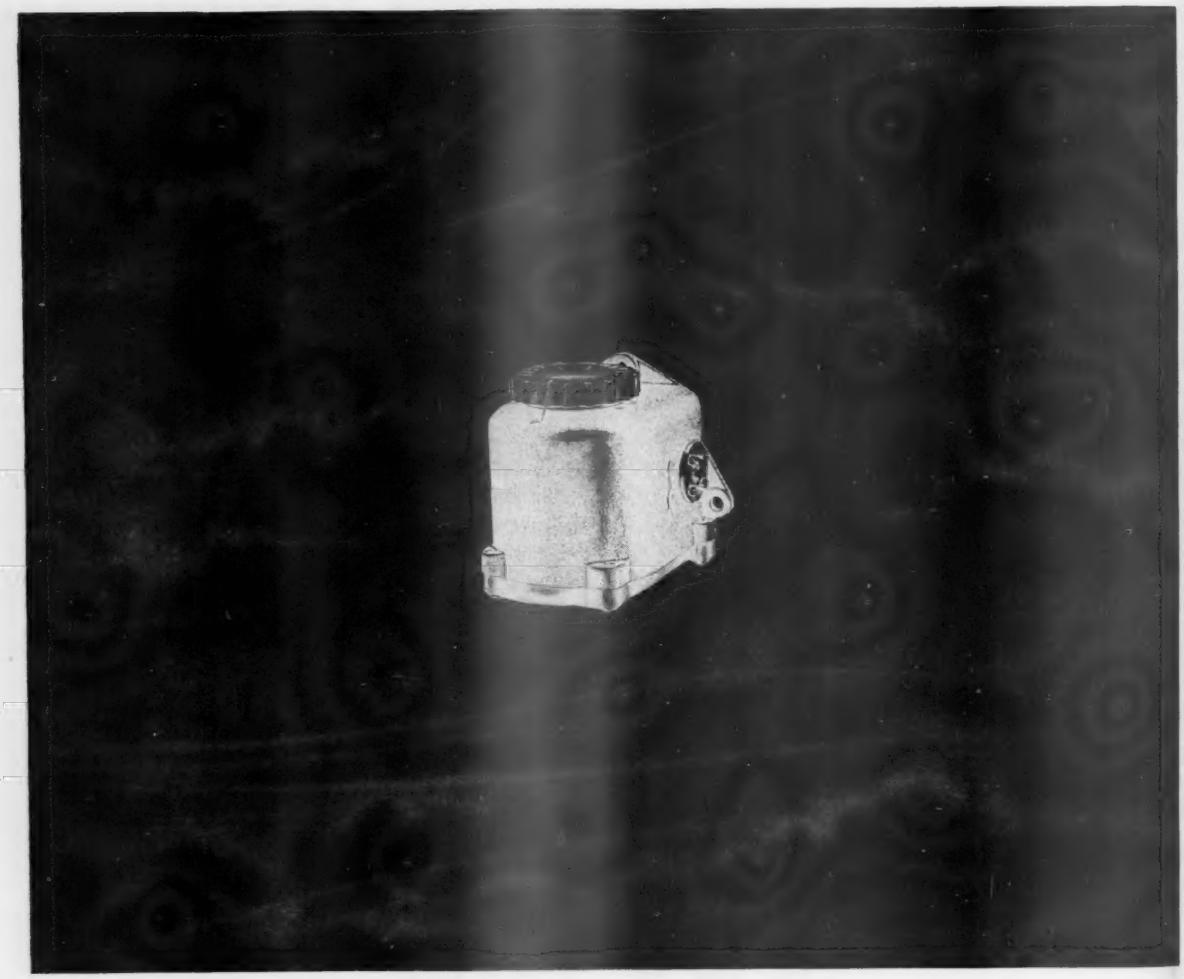

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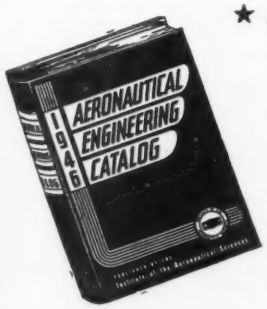

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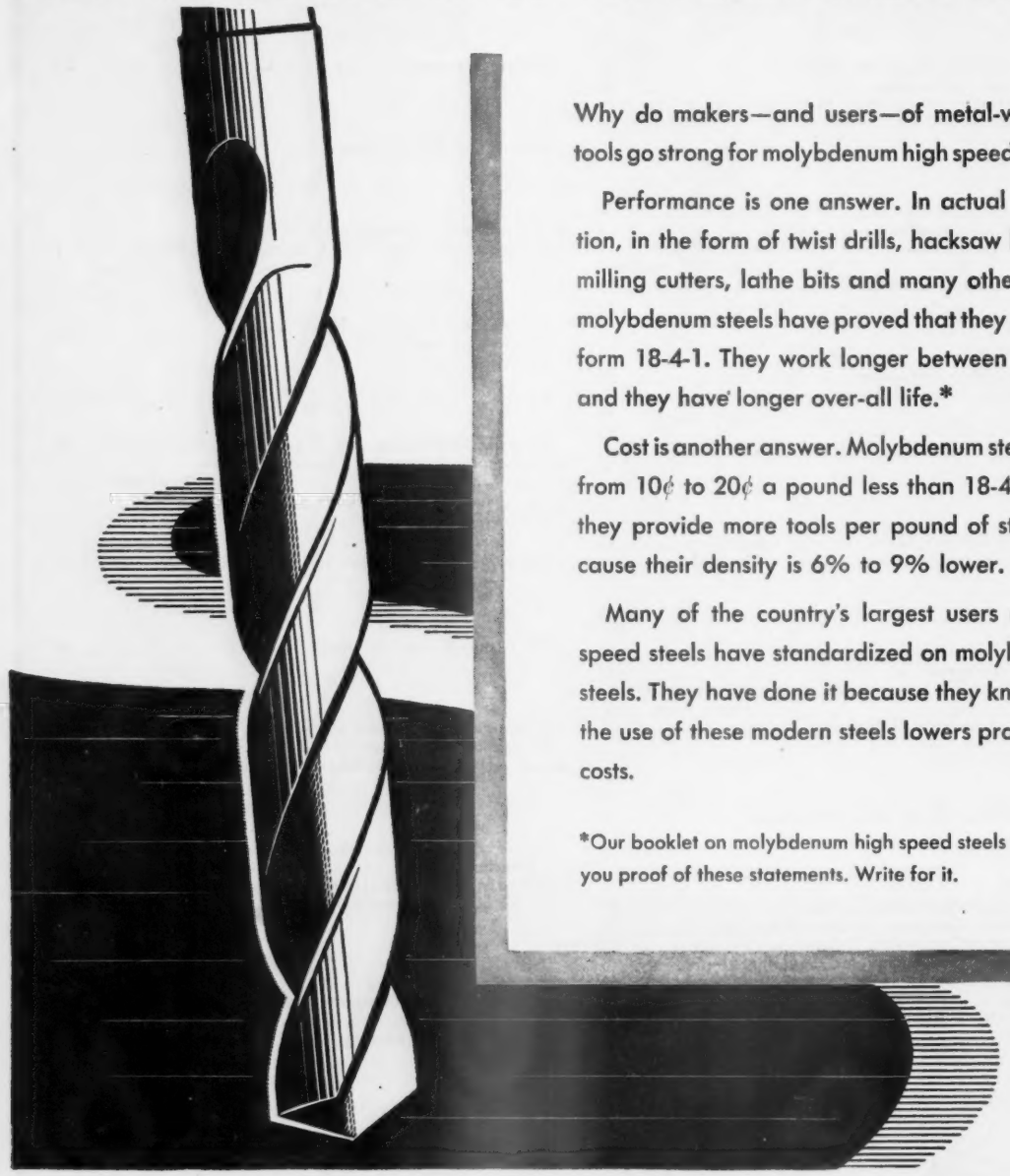

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